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ABSTRACT

Student achievement data from 92 school districts in South Carolina were analyzed to determine which variables were most likely to affect educational quality. Fourth and seventh grade samples were examined to determine the effects on achievement when the shared variation between achievement and the context variables was removed. The data included four context, fourteen input, and five criterion indicators. Context indicators are those quantifiable variables which may affect educational quality but are not subject to change at the state or district level, e.g., local revenue per pupil. Input indicators are those quantifiable characteristics which are subject to manipulation and may significantly relate to learner outcomes, e.g., handicapping conditions. Criterion indicators are quantifiable variables which serve as measures of learner outcomes, e.g., achievement test scores. The classification variable, school grade size, was also introduced to provide for schools which contained only one class per grade level. Major results were obtained through zero-order correlation analyses, and regression analyses. Two context variables--racial composition of student population, and percentage of students receiving free or reduced price lunches--were the best predictors of achievement at both grade levels. Local revenue per pupil and school age population density were also consistently associated with achievement. (MV)

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Indicators of Educational Quality 1975-76

Technical Report

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EDUCATION & WELFARE
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INDICATORS OF EDUCATIONAL QUALITY 1975-76

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INDICATORS OF EDUCATIONAL QUALITY 1975-76

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CHAPTER I

NATURE OF THE INVESTIGATION

Introduction

In May of 1970, the South Carolina State Board of Education adopted "South Carolina's Educational Objectives for 1975", which consisted of Eleven Major Educational Objectives. One of these Major Objectives, the Evaluation Objective, was "to assess annually the educational quality of each school district in South Carolina".

Implicit in the wording of the Evaluation Objective was the assumption that indicators of educational quality could be identified and that once identified those indicators could be measured. Consequently, the general purpose of this objective was to implement an assessment program in order to identify and measure indicators of educational quality that yield information which has utility in educational decision making.

One specific purpose of the Evaluation Objective was that of determining the quality of the educational program offered in South Carolina through the State's system of free public education. Implied in this purpose was the necessity for collecting and analyzing data to yield information which could be used in the development of educational policy at the State level.

A second specific purpose of the Evaluation Objective Assessment Program was to determine the quality of the educational program which each local school district was providing in the public schools under the district's jurisdiction. Again, this purpose implied the collection and

analysis of data in order to obtain information concerning educational quality. Information of this nature was not to be used for the purpose of publicly ranking or comparing school districts. However, this information was to be used for decision-making purposes within the Department of Education. Additionally, the information could be utilized, in conjunction with data from other sources, as the basis for research on identifying promising educational programs or practices at the school or district levels.

Although not one of the specific purposes of the Evaluation Objective Assessment Program, local districts would have the option of using the data in any manner deemed appropriate by the district. The Department's intent was that district data would be relevant to decision making at the local level. In order to facilitate usage of the data at the district level, the Department of Education would provide assistance, to the extent possible, in the interpretation of data generated through the objective's assessment program.

In order to fulfill the requirements of the Evaluation Objective, those factors which seemed to be indicative of educational quality had to be identified. Therefore, the Department Evaluation Planning Committee was assigned the task of identifying these indicators of educational quality. The initial identification of these indicators was necessarily limited to those indicators which were suggested in the assessment programs of other states and the philosophy, goals, objectives, and policies of the State Board of Education. The initial identification concentrated on existing departmental data related to educational outcomes. Based upon this information, personal knowledge, and experience, the Committee

identified factors which were felt to be related to educational quality. These factors were termed indicators of educational quality. For purposes of the Evaluation Objective Assessment Program, the indicators of quality were classified into three categories by the Committee. The three categories and their definitions follow:

1. Context indicators or constraints are those quantifiable characteristics or variables which may affect educational quality but which are not subject to manipulation or change at the State or local district level.
2. Input indicators are quantifiable characteristics or variables which are subject to manipulation or change at the State or local level and which by consensus of experts or empirical evidence bear a significant relationship to priority learner outcomes in the areas of knowledge, skills, attitudes, and behaviors.
3. Criterion indicators are quantifiable characteristics or variables which serve as measures of priority learner outcomes in the areas of knowledge, skills, attitudes, and behaviors.

Realizing that obtaining information on all desired student knowledge, skills, attitudes, and behaviors was not logically possible, the Evaluation Planning Committee restricted the categorical definitions to include only priority learner outcomes.

Once the context, input, and criterion indicators had been identified from existing data, a review of the literature was conducted to obtain information as to which context and input indicators were previously found to be most predictive of the criterion indicators. Other areas of interest in the literature review were the identification of additional factors which significantly contributed to educational quality and the statistical procedures utilized in the identification of these factors.

Review of the Literature

The literature concerning the relationship between the inputs and outputs of our educational system has experienced a new spurt of growth in recent years. Studies have attempted to relate almost any input that is quantifiable to outputs of the educational process. This proliferation of research is evidenced by massive summaries of original studies which have attempted to resolve the sometimes conflicting results.

In 1974, John Heim and Lewis Perl summarized approximately 100 studies and presented the studies' results in a monograph, The Educational Production Function: Implications for Educational Manpower Policy. Concentrating on student performance, Heim and Perl classified each variable as either fixed inputs or policy inputs. Fixed inputs were variables that could not be easily altered or manipulated by the policymaker over a short period of time. Policy inputs were variables which were subject to manipulation. Table 1 presents Heim and Perl's summary of studies dealing with the four fixed inputs most commonly found in the literature. The studies are reported in summary form grouped by All Studies Reviewed, Cognitive Domain Development Studies, and Noncognitive Domain Development Studies. The All Studies Reviewed category includes a combination of all the studies in the Cognitive and Noncognitive Domain Development categories, as well as those studies which were not classified in the Cognitive or Noncognitive categories. The Cognitive Domain Development category includes such factors as reading and arithmetic skills. The Noncognitive Domain Development category includes such factors as good study habits, self-esteem, realistic

attitudes toward life, tolerance of others, and responsible citizenship. Each percentage figure in the table is an index of the number of studies in which the variable examined significantly affected student performance. The tabled number in parentheses is the total number of studies that fell into each cell. The first entry in the table may then be interpreted to mean that 96% of 28 studies found student IQ to be significantly related to student achievement.

Table 1
Fixed Input Variables

Variable Examined	Categories			
	All Studies Reviewed	Cognitive Domain Development Studies	Noncognitive Domain Development Studies	
Student IQ	96% (28)	100% (17)	90%	(10)
Student Socioeconomic Status	88% (67)	95% (37)	77%	(26)
Student Race	73% (15)	100% (5)	60%	(10)
School Size	30% (10)	14% (7)	0%	(1)

Although studies within a given cell are not replications of one another, in general, the higher the number of studies per cell the more stable the percentage figure.

The comparable table reported by Heim and Perl for policy input variables follows:

Table 2
Policy Input Variables

Variable Examined	Categories			
	All Studies Reviewed	Cognitive Domain Development Studies	Noncognitive Domain Development Studies	
Teacher Degree Status	83% (12)	75% (6)	100% (3)	
Years of Teaching Experience	57% (23)	43% (14)	75% (8)	
Teacher Socioeconomic Status or Verbal Ability	100% (6)	100% (4)	100% (2)	
Class Size	37% (19)	42% (12)	0% (4)	

In March, 1976, John Heim attempted to summarize more specifically his previous review of literature findings. Concentrating on the differences observed in student socioeconomic levels, Heim came to the general conclusion that an equalization of the socioeconomic level of the different schools within a given district may stimulate the lower socioeconomic students to attain higher levels of performance. Mixing students of highly heterogeneous socioeconomic levels did not seem to hinder the performances of the higher socioeconomic students.

Heim also reviewed a total of eight studies, all of which indicated that a positive relationship existed between students' development in the cognitive domain and students' development in the noncognitive domain. While such a relationship was demonstrated, no cause and effect statements were warranted.

Absenteeism was the subject of six studies reviewed by Heim. In four of these studies (67%), a negative relationship was found between achievement and absenteeism.

Four additional studies reviewed by Heim found no relationship between the number of principals or supervisors and student performance. Only one study in five found a relationship between the number of special supportive staff (guidance counselors, psychologists, and social workers) and students' cognitive performance. Four studies in six displayed a positive relationship between the number of special supportive staff and students' noncognitive performance.

Heim finally summarized research on several financial variables for the cognitive and noncognitive areas (see Table 3). Table 3 follows the same format and interpretation as the previously presented tables.

While such summative studies are very useful in providing the reader with an overall picture, these studies lack a degree of specificity, which allows a more detailed level of understanding of stated variables. Therefore, the remainder of this section is devoted to a discussion of selected articles and their findings.

Table 3
Financial Variables

Financial Variable	Categories			
	All Studies Reviewed	Cognitive Domain Development Studies	Noncognitive Domain Development Studies	
Administrators' Salary	80% (5)	80% (5)		
Teachers' Salary	75% (16)	83% (12)	50% (4)	
Gross Expenditure Level	43% (30)	35% (17)	50% (8)	
Effort Index (School Tax and Wealth of Community)	17% (6)	100% (1)	0% (5)	
Instructional Materials Expenditure per Pupil	0% (3)	0% (3)		

The Federal Reserve Bank of Philadelphia (Summers, A. A., & Wolfe, B. L., 1975) published the results of a study involving schools in Philadelphia. Utilizing information on 1,896 students in 150 different schools, this descriptive study explored the existing relationships between educational inputs and outputs in public schools. Some of the major findings of this study were:

1. Students of different achievement levels in elementary school obtained significantly higher achievement when the student body of the school was 40% to 60% black, when the class size was 33 or less, and when there was a heterogeneous mixture of high and low achievers in each classroom.

2. Students of different achievement levels in junior high performed higher when the school attended was a part of an elementary school, when the class size was 31 or less, and when there was a heterogeneous mixture of high and low achievers in each classroom.
3. Students of a low achievement level in the elementary school performed higher when their class size was 28 or less, when the teacher was new to the teaching process, and when the class was mixed with higher achievers.
4. Students of a higher achievement level performed higher when the elementary teacher was experienced in teaching, when there were fewer dropouts in the school, and when the family relocated less during the junior high years.

Variables in the Federal Reserve Bank study which were investigated and were not significantly related to student achievement included:

1. student participation in headstart program;
2. general physical facilities of the school to include the playground, lab equipment, and school building;
3. principal's experience, graduate degree, or other extra educational credits;
4. teacher's degree beyond a bachelor's or score on the common section of the National Teachers' Examination; and
5. a match between the teacher's race and the student's race.

Innes and Cormier (1973) found a correlation coefficient of .95 between predicted and actual achievement means for a small sample of 15 schools. However, these results should be viewed with caution since eight predictors were investigated for only 15 cases. These factors were students':

1. expectation for excellence,
2. socioeconomic status,
3. attitude toward life,
4. family structure and stability,
5. educational desires and plans,

6. race,
7. degree of reading at home, and
8. sex.

Heim and Perl (1974) nonrandomly selected 63 districts in the State of New York and investigated the relationship between assorted variables and reading and math test scores for beginning 3rd and 6th graders. Heim and Perl's findings are summarized in Table 4. A plus ("+") entry indicates a significant positive relationship, a zero ("0") entry indicates no significant relationship, a minus ("-") entry indicates a significant negative relationship, and a blank indicates that the relationship was not investigated.

The most surprising entry in Table 4 is the row of pluses ("+'s"), indicating that the variable concerning the use of a performing arts program was significantly and positively related to student performance. The authors conjectured that the reason for this phenomenon was that "A well-developed performing arts program could possibly create a 'tone' or atmosphere conducive to learning that otherwise might not be present in a school" (p. 19). However; the presence of performing arts programs was not correlated with the average socioeconomic level of students in each school district. Consequently, the relationship between achievement and the presence of performing arts program was not simply a proxy for the established relationship between achievement and socioeconomic status.

William Burson (1972) in a report of the Pennsylvania Assessment Program described the results of multiple regression techniques for

Table 4
The Relationship between Assorted Variables and
Reading and Math Achievement

Variable	3rd Grade		6th Grade	
	Reading	Math	Reading	Math
Student Socioeconomic Level	+	+	+	0
Student Race	+	+	+	+
Rural Background	+	+	+	0
Class Size	+	+	+	0
Teacher's Highest Degree	0	0	+	+
Teacher's Experience in Years	0	0	0	0
Use of Performing Arts Program	+	+	+	+
Use of Open Circuit TV	-	0	-	-
Use of Programmed Learning	0	0	-	-
Use of Closed Circuit TV	0	-	-	-
Teacher In-service Training	0		-	

several dependent variables. Table 5 briefly summarizes the results of this study by reporting the total percent of explained variability. The percentage index ranges from 0 to 100 with higher numbers representing a more accurate prediction of the dependent variable. The number of independent variables fluctuates from cell to cell from a high of 14 to a low of 9.

Table 5
The Amount of Variability Explained by
the School's Socioeconomic Status

School Level	Dependent Variable	School's Socioeconomic Status		
		Lo	Mid	Hi
Elementary Schools	Self Understanding	26.6%	34.8%	29.5%
	Understanding Others	42.5%	35.3%	50.1%
	Basic Skills, Verbal	47.8%	29.9%	59.3%
	Basic Skills, Math	44.3%	45.0%	48.1%
Secondary Schools	Self Understanding	64.9%		94.3%
	Understanding Others	83.1%		94.1%
	Basic Skills, Verbal	86.8%		95.0%
	Basic Skills, Math	78.4%		94.0%

In general, students in secondary schools were more predictable than students in elementary schools in terms of achievement. Students attending a high socioeconomic secondary school were the most predictable, while students attending a middle socioeconomic elementary school were the least predictable.

In 1972, Ian Templeton reviewed the available literature on the possible relationship between class size and student performance. The findings of this investigation were so varied that Templeton finally concluded: "The variations in criteria employed, grade levels studied, and sizes of samples used in the various studies make it nearly impossible to reach any firm conclusions about the relationship between class size and educational quality" (p. 6). The literature since 1972 has yielded no evidence that would alter Templeton's conclusion.

Carson, Crouthamel, and Robbins (1972) examined the relationship between socioeconomic level and student achievement in the Atlanta area schools. The results indicated that a substantial relationship existed between achievement and socioeconomic factors in the three grades tested, Grades 4, 8, and 11. The study identified schools in which students were achieving at a significantly higher or lower level than would be expected. While the Carson et. al. study was most similar to the present study, the Carson study differed significantly from the present South Carolina study. The Carson et. al. study made extensive use of census data; the South Carolina Indicators of Educational Quality study proposed to use school data as predictors of student achievement. Two school indicators that Carson et. al. found to be useful were included in the South Carolina study.

The review of literature revealed that no consistent relationships have been established among indicators of educational quality. Inconsistencies in the definitions of these indicators or factors existed from study to study. Thus, these inconsistencies made the determination of the factors or variables that are crucial in predicting academic achievement virtually impossible. Since most of the reviewed studies represent regional approaches, none of which approximate South Carolina's population, the results from these studies are not directly applicable in South Carolina. Thus, because of the lack of congruity among variables previously examined and the lack of geographical conformity between the research samples and South Carolina's population, the decision was made to initiate a project to determine which variables are significant predictors of achievement in South Carolina.

Statement of the Problem

The Indicators of Educational Quality Project was designed as a two-phase process: (1) District Profile Reports and (2) the Indicators of Educational Quality Technical Report, which contains statistical analyses of the data compiled for the District Profile Reports.

The first phase of the process consisted of providing each of the 92 districts in the State with a District Profile Report or status report at the district level. The District Profile Report was compiled to aggregate district information on all of those indicators or variables which were identified by the Evaluation Committee as potentially related to student achievement. Descriptive information on these

indicators as they existed within the district was obtained from data available within the Department and was presented in the profile report in the form of percentages, dollar values, and ratios. The data sources for these indicators are stated in the "Definitions of the Variables Section" of Chapter II. Once these data were compiled, an edit of the data was conducted by Department personnel for the purpose of quality control. The district profiles were compiled to provide districts with descriptive information that would aid in the interpretation of test scores and hopefully assist district personnel by providing insight into the evaluation of student achievement within the district. Additionally, the district profiles included State data so that districts could compare district data with the State data. Phase One of the project was completed when each district superintendent was provided a complete printout of his district profile at the Annual School Administrator's Conference in Myrtle Beach in July, 1976. (See Appendix A for a mock-up of a district profile.)

The second phase of the project and the focus of this report, Indicators of Educational Quality, involved the statistical analyses of the data compiled for the district profiles. The purpose of these statistical analyses was to determine which of the indicators were most critical in making a difference in educational quality. That is, school and district level data were analyzed in an attempt to identify which variables were related to student achievement. The assumption was that those indicators of quality identified through the analyses would be of aid to district personnel in the interpretation of district test data.

Furthermore, the information on the relationships between student achievement and input variables (including policy and financial inputs as described in the literature review) would hopefully be used in making decisions concerning district and State priorities and spending.

Thus, the following research questions, one at the 4th and one at the 7th grade levels, were the primary questions addressed in the second phase of the project:

1. What input variables are related to achievement in the 4th grade when the shared variation between achievement and the context variables is removed?
2. What input variables are related to achievement in the 7th grade when the shared variation between achievement and the context variables is removed?

In addition to the identification of the indicators of educational quality, the obtained relationships between these indicators and student achievement were to be used to predict average school performance levels. Using these predictions, schools that scored higher or lower than expected were to be identified in order to facilitate in-depth studies in identifying factors not included in the data set which might contribute to outstanding student performance. This aspect of the report is referred to as the identification of outlier schools.

Thus, the Indicators of Educational Quality Report is limited to determining the status of identified indicators of educational quality rather than attempting to provide diagnostic information. Therefore, when problems or needs are identified through the Indicators of Educational

Quality Project, further study, either locally or statewide, will be necessary to determine the specifics of the problem.

Since the major objective called for an annual assessment of the educational quality within each school district and because of the limitations on funding and testing time, the selected indicators for assessing educational quality were obtained from existing data bases such as census data, the Basic Educational Data System (BEDS), certification data, and the Defined Minimum Program (DMP) data.

Therefore, the remainder of this report focuses on the second phase of the Indicators of Educational Quality Project. The two aspects of interest in the second phase were: (1) multiple regression analyses to determine the relationship between context, input, and criterion variables and (2) the identification of outlier schools in which mean achievement differed substantially from predicted achievement.

CHAPTER II

PROCEDURES AND METHODOLOGY

Introduction

The purpose of this chapter is to discuss the procedures and methodology used in the implementation of the project design. The chapter is divided into four major sections. In the first section, entitled "Definitions of the Variables", the variable definitions, data sources, and collection procedures are discussed. An examination of the logical clusters of variables is provided in the second section, entitled "Variable Modifications". The third section, entitled "Sample", presents information concerning the sample of students that was used in the project. The fourth section, entitled "Procedures", gives a brief summary of the procedures followed in the analyses of the project data.

Definitions of the Variables

The data which were utilized in this project consisted of four context indicators, fourteen input indicators, and five criterion indicators. Descriptions of these three categories of indicators, as well as their data sources, are presented in this section of the report.

Context Indicators

The context indicators or constraints are those quantifiable characteristics or variables which may affect educational quality but which are not subject to manipulation or change at the State or local

district level.

The four context indicators included in this study and their data sources were as follows: Racial Composition of Student Population, Attendance Report; Percentage of Students Receiving Free or Reduced Price Lunches, Lunchroom Supervisor's Report; Local Revenue per Pupil, District Superintendent's Annual Report; and Sparsity Index, Census Data.

Input Indicators

The input indicators are those quantifiable characteristics or variables which are subject to manipulation or change at the State or local level and which by consensus of experts or empirical evidence may bear a significant relationship to priority learner outcomes in the areas of knowledge, skills, attitudes, and behaviors.

The fourteen input indicators and their sources included: Attendance, District Superintendent's Annual Report; Handicapping Conditions, Office of Programs for Handicapped; Kindergarten Enrollment, Basic Educational Data System (BEDS) and Attendance Reports; Enrollment of Students by Average Class Size, BEDS; Teacher's Education, BEDS; Administrator's Education, BEDS; Teacher Experience, BEDS; Teacher Certification, BEDS; Teacher Salary, BEDS; Noninstructional Staff Salary, BEDS; Teacher Turn-over Rate, State Aid File; Expenditure per Pupil, District Superintendent's Annual Report; Percent of District Personnel in the Central Office, BEDS; and Tax Levy, District Superintendent's Annual Report.

Criterion Indicators

The criterion indicators are quantifiable characteristics or variables which serve as measures of priority learner outcomes in the areas of knowledge, skills, attitudes, and behaviors.

The five criterion variables and their data sources were: Achievement Test Scores on the content areas of Reading, Mathematics, Language, Total Battery, and Reference Skills, Comprehensive Tests of Basic Skills scores from the Statewide Testing Program; Attitude Scores on the Individual Adequacy and Social Adequacy Subscales, Psycho-Social Maturity Scale scores from the Statewide Testing Program; Dropout Rate, Dropout Report; Employment Rate of Terminal Vocational Students, Vocational Follow-up; and Post-Secondary Enrollment, BEDS.

Classification Variable

The classification variable school grade size, referred to as SIZE, was introduced into the study for analysis purposes because there were some public schools containing one class per grade level. In these schools factors incidental to the class (e.g., the characteristics of the teacher) might have more meaning than the specific factors of interest in this study. Also, the character of such schools, many of which presumably contain several grades, might be quite different from schools with more typical class distributions in each grade. Based on this rationale, the SIZE variable was introduced.

The estimated size of the student body per grade (SIZE) was obtained by dividing the Average Daily Attendance (ADA) by the number of grades in the school (kindergarten excluded). A school in the sample

was classified as "small" if the school contained an average of 35 or fewer students per grade, as "medium" if the school contained an average of 36 to 70 students per grade, and "large" if the school contained more than 70 students per grade. Consequently, there were three school size groups for each of the 4th and 7th grade levels for a total of six school size groups. Many of the analyses which are described in Chapter III of this report were performed individually for each of the six size groups. Within small schools, SIZE was viewed as a measure of class size, since, given the available data, an alternative method of constructing such a measure was not available.

Predictor Variables

The term predictor variables was used to refer to both context and input variables since these two types of variables were examined in terms of predicting student performance on the criterion variables.

Additional Variable Information

The complete definitions of each indicator were included on each district's profile report. Additionally, narrative descriptions of all variables and the labels used to refer to the variables throughout this report are given following the profile mockup in Appendix A.

When possible, the data were reported as percentages to enable comparisons between two or more schools on various indicators. Unfortunately, school-level data were not available for many of the variables of interest; and, therefore, district data were used in these cases.

Most of the non-test data came from the Basic Educational Data System (BEDS), and most of the test data came from the Educational Assessment Section Statewide Testing Program data; however, some of the statistics in this study may vary in comparison to those presented in other reports because of the manner in which the data have been re-organized. Whenever possible, the intention of the report was to provide data that are compatible with those found in other published reports.

Variable Modifications

An examination of the list of variables in the study revealed several logical clusters of variables. For example, one cluster consisted of the mean salary of teachers at each of six teacher educational levels and the mean salary of all teachers within a district. Mean salaries among different teacher educational levels were generally either high or low for all educational levels within a district. The inclusion of all seven of these variables in a regression analysis seemed unwarranted, since each of the seven variables contributed little unique variation to a criterion variable. Such clusters were scrutinized to identify a single predictor, some combination of elements in the cluster, or some transformation of these elements which predicted a criterion variable optimally. This approach was used for several clusters of variables.

An analysis of descriptive statistics on the variables in the study identified several variables with skewed distributions. Transformations

of such variables were identified which caused the resultant distribution to be more symmetric, an assumption underlying most of the subsequent analyses. These selection decisions and transformations produced the following new variables not previously defined:

1. REVLG is the common logarithm of REVENUE;
2. SPARLG is the common logarithm of SPARCITY;
3. SPECPC is the sum of percentages of pupils by handicapping conditions (TRAINPCT, EDUPCT, ORTHOPCT, EMOTLPCT, HEARPCT, VISULPCT, and LEARNPCT);
4. SPECCLG is the common logarithm of SPECPC;
5. TLG1 is the common logarithm of T_ED_1.
6. AD456 is the sum of AD_ED_4, AD_ED_5, and AD_ED_6;
7. NOCSQ is the positive square root of NO_CERT; and
8. ADALG is the common logarithm of ADA.

These modified variables were added to the original data set. Also, two input variables, BATT4N and BATT7N, were added. A more complex discussion of the rationale supporting these decisions concerning data reduction and transformation is presented in Appendix B.

Sample

Initially, information was available on 1,189 South Carolina public schools. The analysis of the project data, however, required the establishment of criteria for the determination of those schools that were included in the project data set.

The primary eligibility criterion was the availability of Statewide Testing Program data at the school level. These test data were necessary for the measurement of the criterion variables (see the "Definitions of

Variables Section" of this chapter). The second eligibility criterion concerned the organizational structure of the schools. Since one of the primary objectives of this study was to identify what is often referred to as "school effects," the following assumption was made: for the school effects to be reflected in student performance, the student must have been enrolled in the school for at least one year. Since the Statewide Testing Program data were collected in the fall of the school year, only schools which housed both a 3rd and a 4th grade were included in the 4th grade analyses; and only schools which housed both a 6th and a 7th grade were included in the 7th grade analyses.

The final sample sizes at the 4th and 7th grade levels were determined by eliminating schools that did not meet the eligibility criteria. Statewide Testing Program data were not available for four districts at the 4th grade level and for three districts at the 7th grade level. Consequently, schools in these districts were excluded. Schools which enrolled only special education students were likewise eliminated since special education students were not tested as part of the Statewide Testing Program. The schools eliminated because of unacceptable organizational structures were primarily those housing Grades 8 to 12, Grades 10 to 12, and Grades 11 to 12. The resultant sample at the 4th grade level consisted of 514 schools, and the resultant sample at the 7th grade level consisted of 188 schools. Of the 514 4th grade schools and 188 7th grade schools, 94 schools were considered both 4th and 7th grade eligible.

Table 6 presents descriptive information on school organizational patterns for 4th and 7th grade eligible schools by the SIZE variable classifications. Although the K-6 organizational pattern is the mode for 4th grade small and medium schools, the K-5 pattern is most popular for the large schools. The mean number of grades for the two groups indicated that the expected tendency for the larger schools was to contain fewer grades. The same trend occurred in the 7th grade, with the middle school structure being dominant among the large schools. An interesting point is that all 20 small schools providing 7th grade data were also included among the 63 small schools providing 4th grade data.

Summary descriptive data for the eligible schools at the 4th and 7th grade levels are presented in Table 7 for the context, input, and criterion variables. As indicated in Table 7, the percentage of white students in the schools ranged from 0 to 100 at both grade levels. Fourth grade schools had a somewhat higher average percentage of white students than 7th grade schools. The percentages were 58% and 52%, respectively. Since these figures were unweighted averages of percentages, these figures were not comparable to percentages which would have been obtained by aggregating students. The fact that the percentages of students receiving free and reduced lunch was higher for 7th grade schools suggested that a somewhat lower socioeconomic condition existed in 7th grade schools than in 4th grade schools. Teacher and administrator educational levels and teacher and non-instructional staff salaries

Table 6

Descriptive Information for 4th Grade and 7th Grade Eligible Schools by Size Classification

Grade	Group	<u>n</u>	Organizational Pattern			M No. of Grades	M ADA	M SIZE	M* BATT_N
			Most Freq. %	Second Most Freq. %	Third Most Freq. %				
4	Small	63	K-6 (37%)	K-8 (17%)	1-6 (14%)	6.3	174	27	23
4	Medium	161	K-6 (39%)	K-5 (22%)	K-7 (12%)	5.9	318	54	46
4	Large	<u>291</u> 515	K-5 (40%)	K-6 (29%)	K-4 (12%)	5.3	564	110	95
7	Small	20	K-8 (55%)	K-7 (20%)	1-7 (15%)	7.7	211	27	27
7	Medium	40	K-7 (48%)	K-8 (35%)	5-8 (8%)	6.9	357	52	52
7	Large	<u>132</u> 192	6-8 (44%)	5-8 (17%)	K-7 (14%)	4.2	714	197	184

*In this table BATT_N is used to denote BATT4N or BATT7N depending on the grade level.

Table 7
Summary Descriptive Data for Eligible Schools by Grade

Variable	Eligible 4th Grade Schools					Eligible 7th Grade Schools				
	<u>n</u>	<u>M</u>	<u>SD</u>	Low	High	<u>n</u>	<u>M</u>	<u>SD</u>	Low	High
WHITEPCT	514	58.42	29.33	.00	100.00	188	52.09	31.14	.00	100.00
ATTENPCT	514	94.72	1.60	88.00	99.00	188	94.08	2.18	84.00	100.00
LUNCHPCT	514	49.66	24.71	.00	99.40	188	57.87	25.85	6.10	99.50
REVENUE	514	287.47	111.07	84.00	723.00	188	250.40	91.93	84.00	629.00
SPARCITY	514	37.87	35.90	4.00	197.00	188	30.85	28.48	4.00	177.00
TRAINPCT	514	.33	.24	.00	1.40	188	.32	.25	.00	1.40
EDUCPCT	514	1.50	1.56	.00	8.60	188	1.56	1.54	.00	8.60
ORTHOPCT	514	.04	.07	.00	.50	188	.03	.08	.00	.50
EMOTLPCT	514	.13	.18	.00	1.60	188	.12	.16	.00	1.10
HEARPCT	514	.04	.05	.00	.10	188	.03	.05	.00	.10
VISULPCT	514	.00	.00	.00	.00	188	.00	.00	.00	.00
LEARNPCT	514	.07	.13	.00	.50	188	.07	.11	.00	.50
K_1STPCT	514	53.68	15.09	.00	127.00	188	59.30	18.07	23.00	127.00
ENGCLASS	0	.00	.00	.00	.00	4	25.50	.58	25.00	26.00
MATHCLAS	0	.00	.00	.00	.00	4	26.50	1.91	24.00	28.00
HISTCLAS	0	.00	.00	.00	.00	4	26.00	4.24	20.00	29.00
SCICLASS	0	.00	.00	.00	.00	4	27.00	.82	26.00	28.00
T_ED_1	514	.80	2.80	.00	28.00	188	.94	2.53	.00	16.00
T_ED_2	514	51.98	17.13	.00	100.00	188	53.84	14.99	12.00	93.00
T_ED_3	514	27.25	14.10	.00	79.00	188	23.73	12.51	.00	69.00
T_ED_4	514	18.11	12.13	.00	79.00	188	19.38	11.53	.00	75.00
T_ED_5	514	.25	1.17	.00	11.00	188	.35	1.11	.00	7.00
T_ED_6	514	.04	.46	.00	8.00	188	.04	.39	.00	5.00
T_ED_ALL	514	21.55	8.57	5.00	62.00	188	28.48	13.70	7.00	76.00

Table 7 (continued)

Summary Descriptive Data for Eligible Schools by Grade

Variable	Eligible 4th Grade Schools					Eligible 7th Grade Schools				
	<u>n</u>	<u>M</u>	<u>SD</u>	Low	High	<u>n</u>	<u>M</u>	<u>SD</u>	Low	High
AD_ED_1	514	.60	2.43	.00	28.00	188	.81	3.02	.00	28.00
AD_ED_2	514	5.78	4.81	.00	27.00	188	6.05	5.58	.00	28.00
AD_ED_3	514	8.21	6.93	.00	41.00	188	9.50	9.37	.00	42.00
AD_ED_4	514	72.92	7.35	33.00	100.00	188	72.76	8.97	28.00	100.00
AD_ED_5	514	6.97	5.22	.00	33.00	188	5.92	5.10	.00	21.00
AD_ED_6	514	3.21	2.88	.00	16.00	188	2.74	2.94	.00	11.00
AD_ED_TL	514	81.14	78.50	2.00	242.00	188	84.43	85.89	3.00	242.00
YRS_EXP	514	11.97	5.08	.99	29.99	188	12.67	5.08	2.91	26.13
NO_CERT	514	7.01	9.39	.00	50.88	188	6.93	8.03	.00	42.13
T_SAL_1	58	7766.66	1489.27	3569.00	10419.00	34	7985.29	1652.07	3569.00	10404.00
T_SAL_2	512	8519.65	478.86	6249.00	9647.00	188	8351.19	529.86	6249.00	9647.00
T_SAL_3	498	9761.27	546.50	7848.00	10651.00	186	9568.51	564.75	7970.00	10632.00
T_SAL_4	27	10828.30	593.72	8654.00	11588.00	25	10860.24	364.04	10427.00	11588.00
T_SAL_5	372	11752.16	802.43	10040.00	14431.00	122	11573.43	778.45	9861.00	14431.00
T_SAL_6	4	12371.25	1495.83	10257.00	13597.00	2	13359.50	181.73	13231.00	13488.00
T_SAL_TL	514	10040.57	840.74	7341.00	12018.00	188	9824.50	945.50	7341.00	12018.00
NI_SAL_1	34	7443.18	4048.79	3456.00	14316.00	14	6252.00	3690.96	3456.00	14316.00
NI_SAL_2	501	8907.50	774.72	6784.00	11348.00	183	8790.62	616.62	6816.00	10681.00
NI_SAL_3	510	10189.13	882.75	7200.00	14928.00	185	10055.83	912.49	8118.00	14928.00
NI_SAL_4	511	11456.17	809.94	7104.00	16065.00	186	11215.49	838.21	7104.00	13146.00
NI_SAL_5	306	12841.67	1080.39	9415.00	15273.00	90	12826.46	786.85	9415.00	15273.00
NI_SAL_6	61	13531.10	607.70	10461.00	13675.00	21	13619.05	256.41	12500.00	13675.00
NI_SAL_T	514	10577.64	950.00	6992.00	13304.00	188	10316.28	1033.84	8241.00	13304.00

Table 7 (continued)
Summary Descriptive Data for Eligible Schools by Grade

Variable	Eligible 4th Grade Schools					Eligible 7th Grade Schools				
	<u>n</u>	<u>M</u>	<u>SD</u>	Low	High	<u>n</u>	<u>M</u>	<u>SD</u>	Low	High
TURNOVER	514	19.37	4.80	.00	42.11	188	20.46	4.75	4.31	38.50
PERPUPIL	514	922.69	115.08	606.00	1241.00	188	908.47	103.31	652.00	1162.00
CENT_OFF	514	13.40	8.25	.00	60.00	188	15.05	9.62	.00	60.00
TAX_LEVY	314	81.45	15.95	38.00	115.00	128	80.50	16.54	38.00	115.00
READ4	514	34.65	6.76	18.00	59.00	94	54.27	12.91	30.00	88.00
LANG4	514	34.60	7.12	19.00	63.00	94	52.72	13.59	26.00	91.00
MATH4	514	34.73	5.18	18.00	53.00	94	56.27	8.83	31.00	77.00
BATT4	514	34.21	5.98	18.00	55.00	94	54.57	11.11	29.00	82.00
REFER4	514	37.11	7.43	19.00	64.00	94	58.68	15.16	29.00	95.00
SCIENCE4	514	35.31	7.99	17.00	69.00	94	57.62	14.89	28.00	93.00
SOCSTUD4	514	35.66	6.71	20.00	63.00	94	55.18	12.40	28.00	87.00
READ7	94	31.48	5.86	21.00	47.00	188	57.50	12.21	30.00	88.00
LANG7	94	31.60	5.47	21.00	47.00	188	55.90	12.83	26.00	91.00
MATH7	94	32.50	4.75	22.00	48.00	188	58.17	8.02	31.00	77.00
BATT7	94	31.54	5.04	23.00	46.00	188	57.24	10.39	29.00	82.00
REFER7	94	33.52	6.22	22.00	50.00	188	61.34	14.19	29.00	95.00
SCIENCE7	94	31.49	7.10	20.00	53.00	188	60.68	13.64	28.00	94.00
SOCSTUD7	94	32.47	5.85	20.00	46.00	188	57.81	11.93	28.00	92.00
SSAI_IA	61	776.34	49.94	693.00	961.00	133	783.33	43.31	678.00	961.00
SSAI_SA	61	818.13	47.65	729.00	929.00	133	824.34	42.26	715.00	929.00

Table 7 (continued)
Summary Descriptive Data for Eligible Schools by Grade

Variable	Eligible 4th Grade Schools					Eligible 7th Grade Schools				
	<u>n</u>	<u>M</u>	<u>SD</u>	<u>Low</u>	<u>High</u>	<u>n</u>	<u>M</u>	<u>SD</u>	<u>Low</u>	<u>High</u>
DROPOUT	43	.52	.63	.00	2.90	78	.77	1.10	.00	8.10
COLLPCT	514	.00	.00	.00	.00	188	.21	2.84	.00	39.00
EMP_RATE	514	48.51	12.26	16.00	100.00	188	45.99	12.79	16.00	100.00
ADA	514	439.42	203.71	78.00	1266.00	188	589.87	316.61	126.00	1759.00
BATT4N	514	70.81	41.18	9.00	294.00	94	55.49	31.86	14.00	149.00
BATT7N	94	61.95	38.47	14.00	175.00	188	140.36	116.11	14.00	763.00
NGRADE	514	5.60	1.13	2.00	8.00	188	5.11	2.09	2.00	8.00

were quite similar for the two sets of schools. Per pupil expenditure ranged from \$606 to \$1241 and was quite consistent for the two sets of schools. In Table 7, the achievement test data are reported as grade equivalents which have been multiplied by ten. Thus, the average values in grade equivalents of the battery total are properly interpreted as 3.42 and 3.15 for the two sets of 4th grade eligible schools. Similarly, the battery total for the two sets of 7th grade eligible schools are 5.46 and 5.72. Note that in each case, the 94 schools which provided data at both grade levels, predominantly small rural schools, performed at a lower level than schools with more typical organizational patterns.

Procedures

The primary motivation directing the analysis of the relationship between the set of predictor variables (context and input variables) and the criterion variables was to identify input variables which were related to the criterion variables. The focus of the analyses was on the input variables since these variables are the only potentially manipulable variables.

The most direct manner in which this task could be accomplished was to develop a multiple regression equation to predict each criterion variable from the input variables. If the results were to have practical implication, however, a different strategy was suggested. The predictor context and input variables were considered to be synonymous

with the fixed and policy input variables respectively, discussed in the earlier literature review (Heim & Perl, 1974). Since the context variables were assumed not to be manipulable, the proper strategy was to eliminate variation in the criterion variables which was related to the context variables and attempt to identify residual relationships among the criterion and input variables. Residual relationships are those relationships which account for unexplained variation. The reason for this identification process was that input variables, including matters of policy and financing, were the only predictor variables which could be viewed as modifiable. Thus, the following research questions, which were stated in the "Statement of the Problem Section" of Chapter I, were the primary questions addressed in the analyses.

1. What input variables are related to achievement in the 4th grade when the shared variation between achievement and the context variables is removed?
2. What input variables are related to achievement in the 7th grade when the shared variation between achievement and the context variables is removed?

The identification of outlier schools, schools with unexpectedly high or low achievement, was also a task to be performed. Therefore, the development of the prediction equations implied in the two research questions had to precede the identification of outliers.

Following is a brief description of the steps which occurred in the analyses; each step is elaborated in subsequent sections of this report.

1. From the schools for which data were available, two subsets were identified and selected as schools which met minimum standards of eligibility for inclusion in the study through examination of schools' grade organizational structure. One group consisted of schools in which a 3rd grade was present and for which achievement test data were available at the beginning of the 4th grade. The other group was comprised of schools which contained a 6th grade and for which achievement data were available at the beginning of the 7th grade.
2. Within these two groups of schools, descriptive statistics on all variables were examined to determine which of the schools' variables required transformation in order to normalize the distribution of the measures, a pre-condition to much of the later analyses. Variables departing radically from normality were transformed under a new variable name and added to the data set. Other variables were eliminated from further consideration because of lack of data or redundancy with other measures.
3. Simple correlations were computed between the criterion achievement measure and the predictor variables in the data set. Also, each group of eligible schools was further subdivided by the approximate number of classes per grade, into small-, medium-, and large-size school

categories (a proxy for school size); and simple correlations paralleling those for the total group of eligible schools were computed for each category. Variables were selected for further analyses based on the results of these correlation analyses.

4. After removal of the variation in the criterion which the criterion shared with the context variables and removal of the variation in the input variables which the input variables shared with the context variables, the partial correlations of each residualized input variable and the residualized criterion were examined. These partial correlations served to identify relationships between the input variables and the criterion variables which were independent of the effects of context variables.
5. Stepwise regression analyses were performed to select those input variables which contributed significantly to the variation in the residualized criterion.
6. Commonality analyses were performed on each group of eligible schools and each grade-size subgroup to determine the proportion of variation in the criterion uniquely attributable to the context variables and the input variables and that proportion of variation in the criterion which was shared in common by both groups of variables. Regression equations based upon sufficient sample sizes were also examined for stability using a cross-validation procedure.

7. Using the best-fitting stepwise regression models, the criterion measures were residualized on the model and examined to locate outlier schools.

In Chapter III of this report, specific procedures associated with each of the steps described in this section are presented along with resulting tables and a brief discussion of the results. A more comprehensive discussion of the results of the various steps, conclusions based upon these results, and recommendations for future research are included in Chapter IV.

CHAPTER III

RESULTS

Introduction

The results from the project data were obtained by means of a four-stage analysis procedure. This procedure consisted of: zero-order correlation analyses; partial correlation analyses; regression analyses; and outlier analyses. Each of these analyses is discussed in detail in this chapter.

Zero-Order Correlation Analyses

Zero-order or simple product-moment correlations between the predictors and BATT4 were computed for eligible 4th grade schools. Most of the predictor (context and input) variables entered the computation, but some were omitted on the presumption that these predictors were redundant. Because data were available for only a limited number of schools, other predictors were also eliminated from further analyses at this stage. Since the objective was to identify potential predictors of the criterion variables, BATT4 and BATT7, these were the only two criterion variables considered in these analyses. Following is a list of variables which appear in Table 7 of Chapter II but were ignored in computing correlations with BATT4: READ4, LANG4, MATH4, REFER4, SCIENCE4, SOCSTUD4, READ7, LANG7, MATH7, BATT7, REFER7, SCIENCE7, SOCSTUD7, EDUPCT, TRAINPCT, ORTHOPCT, EMOTLPCT, HEARGPCT,

VISULPCT, LEARNPCT, ENGCLASS, MATHCLASS, HISTCLAS, and SCICLASS. Of these variables, the first thirteen were criterion variables closely correlated with BATT4; the next seven were represented by the transformed variables, SPECPCCT and SPECCLG; and the final four contained too few valid observations to be useful. Also excluded were five criterion variables, SSAI_IA, SSAI_SA, DROPOUT, COLLPCCT, and EMP_RATE. The simple correlations between each remaining variable and BATT4 appear in the second column of Table 8. Simple correlations between the retained variables and BATT4 were also computed for the 4th grade eligible schools in each of the three categories of school size mentioned earlier. These correlations are reported in Columns 3-5 of Table 8.

A parallel analysis was conducted on the 7th grade eligible schools, using BATT7 as the criterion. The same variables that were omitted in the BATT4 analysis were omitted from the correlational computations for BATT7. The 7th grade results are reported in Column 2 of Table 9. An additional correlational analysis within each school size category among eligible 7th grade schools is reported in Columns 3-5 of Table 9.

In the following discussion, the relative merits of the predictors, as indicated by the correlations of the predictors with BATT4 and BATT7, are compared. To facilitate the implications of the discussion, two conventions were adopted. They were: (1) variables such as SPARCITY and REVENUE, which are also represented by their common logarithms, were considered as a single variable; and (2) correlations based on "small" sample sizes (e.g., less than 100 cases for the analysis

Table 8
4th Grade Eligible Schools
Simple Correlations between BATT4 and Other Variables

Variable	Group of Schools			
	All Schools <u>r(n)</u>	Small Schools ^a <u>r(n)</u>	Medium Schools ^b <u>r(n)</u>	Large Schools ^c <u>r(n)</u>
WHITEPCT	.666 (514)*	.650 (63)*	.658 (160)*	.690 (291)*
ATTENPCT	.121 (574)	-.134 (63)	.010 (160)	.252 (291)*
LUNCHPCT	-.753 (514)*	-.540 (63)*	-.706 (160)*	-.798 (291)*
REVENUE	.277 (514)*	.478 (63)*	.203 (160)*	.267 (291)*
REVLG	.306 (514)*	.454 (63)*	.281 (160)*	.280 (291)*
SPARCITY	.152 (514)*	.134 (63)	.086 (160)	.123 (291)*
SPARLG	.223 (514)*	.257 (63)*	.161 (160)	.189 (291)*
SPECPCT	-.143 (514)*	-.273 (63)*	-.269 (160)*	-.108 (291)
SPECLG	-.178 (514)*	-.189 (63)	-.173 (160)*	-.183 (291)*
K_1STPCT	-.206 (514)*	-.144 (63)	-.294 (160)*	-.129 (291)
T_ED_1	-.119 (514)*	-.147 (63)	-.151 (160)*	-.079 (291)
TLGI	-.114 (514)*	-.167 (63)	-.145 (160)	-.060 (291)
T_ED_2	-.068 (514)	.088 (63)	-.072 (160)	-.106 (291)
T_ED_3	.086 (514)*	-.030 (63)	.139 (160)	.103 (291)
T_ED_4	.024 (514)	-.027 (63)	-.045 (160)	.048 (291)
T_ED_5	-.027 (514)	-.143 (63)	-.040 (160)	-.007 (291)
T_ED_6	.003 (514)	.128 (63)	.000 (160)	-.057 (291)
T_ED_ALL	.173 (514)*	-.177 (63)	-.092 (160)	.083 (291)
AD_ED_1	-.107 (514)*	-.014 (63)	-.172 (160)*	-.017 (291)
AD_ED_2	-.030 (514)	.060 (63)	.015 (160)	-.037 (291)
AD_ED_3	-.173 (514)*	-.151 (63)	-.206 (160)*	-.135 (291)*
AD_ED_4	.037 (514)	-.152 (63)	.174 (160)	-.053 (291)
AD_ED_5	.177 (514)*	.208 (63)	.094 (160)	.197 (291)*
AD_ED_6	.110 (514)*	.097 (63)	.121 (160)	.079 (291)
AD456	.191 (514)*	.106 (63)	.242 (160)*	.123 (291)*
AD_ED_TL	.047 (514)	.007 (63)	.107 (160)	-.003 (291)
YRS_EXP	-.195 (514)*	-.154 (63)	-.251 (160)*	-.155 (291)*
NO_CERT	-.008 (514)	-.107 (63)	.044 (160)	-.017 (291)
NOCSQ	-.046 (514)	-.125 (63)	-.028 (160)	-.039 (291)
T_SAL_1	.246 (58)	.110 (10)	.121 (19)	.277 (29)
T_SAL_2	.267 (512)*	.364 (61)*	.315 (160)*	.214 (291)*
T_SAL_3	.220 (498)*	.267 (54)*	.273 (156)*	.181 (288)*
T_SAL_4	.244 (27)	.327 (3)	.664 (5)	.306 (19)
T_SAL_5	.208 (372)*	.393 (36)*	.209 (107)*	.205 (229)*
T_SAL_6	.539 (4)	1.000 (1)	.000 (0)	.584 (3)
T_SAL_TL	.237 (514)*	.157 (63)	.301 (160)*	.204 (291)*

Table 8 (continued)

4th Grade Eligible Schools

Simple Correlations between BATT4 and Other Variables

Variable	Group of Schools			
	All Schools <u>r(n)</u>	Small Schools ^a <u>r(n)</u>	Medium Schools ^b <u>r(n)</u>	Large Schools ^c <u>r(n)</u>
NI_SAL_1	.385 (35)*	.433 (11)	.217 (9)	.470 (14)
NI_SAL_2	.112 (501)*	.365 (59)*	.185 (158)*	.012 (284)
NI_SAL_3	.130 (510)*	.206 (62)	.195 (160)*	.095 (288)
NI_SAL_4	.125 (511)*	.092 (63)	.102 (159)	.146 (289)*
NI_SAL_5	.192 (306)*	.357 (22)	.293 (92)*	.166 (192)*
NI_SAL_6	.209 (61)	-.302 (7)	.000 (15)	.288 (39)
NI_SAL_T	.238 (514)*	.361 (63)*	.246 (160)*	.193 (291)*
TURNOVER	.001 (514)	.019 (63)	.069 (160)	-.052 (291)
PERPUPIL	.096 (514)*	.055 (63)	-.076 (160)	-.113 (291)*
CENT OFF	.131 (514)*	-.067 (63)	-.199 (160)*	-.078 (291)
TAX LEVY	.266 (314)*	.150 (35)	.206 (101)*	.280 (178)*
BATT7	.783 (94)*	.716 (24)*	.634 (38)*	.913 (32)*
SSAI_IA	.390 (61)*	.648 (20)*	.366 (25)	.306 (16)
SSAI_SA	.427 (61)*	.489 (20)*	.373 (25)	.561 (16)*
DROPOUT	.005 (43)	-.410 (6)	.552 (12)	-.160 (25)
COLLPCT	.000 (514)	.000 (63)	.000 (160)	.000 (291)
EMP_RATE	.150 (514)*	-.112 (63)	.111 (160)	.212 (291)*
ADA	.238 (514)*	-.183 (63)	-.055 (160)	.181 (291)*
ADALG	.217 (514)*	-.135 (63)	.056 (160)	.197 (291)*
BATT4N	.207 (514)*	-.278 (63)*	.032 (160)	.105 (291)
BATT7N	.139 (94)*	-.295 (24)	.004 (38)	.128 (32)
NGRADE	.113 (514)*	-.182 (63)	-.177 (160)*	.045 (291)

* $p < .05$.

^aSmall schools contain approximately one class per grade.

^bMedium schools contain approximately two classes per grade.

^cLarge schools contain more than two classes per grade.

Table 9
7th Grade Eligible Schools
Simple Correlations Between BATT7 and Other Variables

Variable	Group of Schools			
	All Schools <u>r(n)</u>	Small Schools ^a <u>r(n)</u>	Medium Schools ^b <u>r(n)</u>	Large Schools ^c <u>r(n)</u>
WHITEPCT	.782 (188)*	.754 (20)*	.788 (38)*	.810 (130)
ATTENPCT	-.124 (188)	-.113 (20)	-.086 (38)	-.062 (130)
LUNCHPCT	-.834 (188)*	-.793 (20)*	-.769 (38)*	-.843 (130)*
REVENUE	.306 (188)*	.793 (20)*	.296 (38)	.245 (130)*
REVLG	.327 (188)*	.807 (20)*	.286 (38)	.282 (130)*
SPARCITY	.278 (188)*	.632 (20)*	.344 (38)*	.200 (130)*
SPARLG	.315 (188)*	.713 (20)*	.311 (38)*	.214 (130)*
SPECPC	-.243 (188)*	-.485 (20)*	-.210 (38)	-.214 (130)*
SPECLG	-.204 (188)*	-.288 (20)	-.055 (38)	-.257 (130)*
K_1STPCT	-.219 (188)*	-.429 (20)	-.357 (38)*	-.136 (130)
T_ED_1	-.206 (188)*	-.498 (20)*	-.320 (38)*	-.058 (130)
TLGT	-.220 (188)*	-.516 (20)*	-.355 (38)	-.076 (130)
T_ED_2	-.024 (188)	-.261 (20)	.112 (38)	-.037 (130)
T_ED_3	-.020 (188)	.197 (20)	.110 (38)	-.044 (130)
T_ED_4	.095 (188)	.254 (20)	-.229 (38)	.097 (130)
T_ED_5	.029 (188)	.029 (20)	-.189 (38)	.063 (130)
T_ED_6	.000 (188)	.000 (20)	.000 (38)	-.016 (130)
T_ED_ALL	.360 (188)*	.248 (20)	-.030 (38)	.339 (130)*
AD_ED_1	-.127 (188)	-.218 (20)	-.227 (38)	-.136 (130)
AD_ED_2	-.119 (188)	-.351 (20)	-.057 (38)	-.095 (130)
AD_ED_3	-.153 (188)*	.026 (20)	-.431 (38)*	-.070 (130)
AD_ED_4	.062 (188)	-.359 (20)	.389 (38)*	-.007 (130)
AD_ED_5	.314 (188)*	.590 (20)*	.236 (38)	.323 (130)*
AD_ED_6	.060 (188)	-.146 (20)	.304 (38)	-.000 (130)
AD456	.223 (188)*	.208 (20)	.492 (38)*	.141 (130)
AD_ED_TL	.157 (188)*	.445 (20)*	.320 (38)*	.051 (130)
YRS_EXP	-.297 (188)*	.133 (20)	-.286 (38)	-.358 (130)*
NO_CERT	-.125 (188)	-.282 (20)	.044 (38)	-.148 (130)
NOCSQ	-.140 (188)*	-.364 (20)	-.021 (38)	.132 (130)
T_SAL_1	.520 (34)*	.100 (5)	.865 (8)*	.258 (21)
T_SAL_2	.390 (188)*	.666 (20)*	.467 (38)*	.329 (130)*
T_SAL_3	.328 (186)*	.633 (19)*	.468 (38)*	.270 (129)*
T_SAL_4	-.001 (25)	1.000 (2)	1.000 (1)	-.135 (22)
T_SAL_5	.367 (122)*	.857 (13)*	.428 (21)*	.283 (88)*
T_SAL_6	1.000 (2)	.000 (0)	.000 (0)	1.000 (2)
T_SAL_TL	.367 (188)*	.639 (20)*	.492 (38)*	.274 (130)*

Table 9 (continued)
 7th Grade Eligible Schools
 Simple Correlations Between BATT7 and Other Variables

Variable	Group of Schools			
	All Schools <u>r(n)</u>	Small Schools ^a <u>r(n)</u>	Medium Schools ^b <u>r(n)</u>	Large Schools ^c <u>r(n)</u>
NI_SAL_1	.743 (14)*	.000 (4)	1.000 (2)	.661 (8)
NI_SAL_2	.190 (183)*	.531 (20)*	.301 (38)	.125 (125)
NI_SAL_3	.228 (185)*	.556 (20)*	.329 (38)*	.171 (127)
NI_SAL_4	.113 (186)*	.120 (20)	.172 (38)	.082 (128)
NI_SAL_5	.186 (90)	.817 (7)	.411 (17)	.138 (66)
NI_SAL_6	-.191 (21)	.000 (2)	.000 (2)	-.220 (17)
NI_SAL_T	.296 (188)*	.621 (20)*	.325 (38)*	.207 (130)*
TURNOVER	-.136 (188)	-.466 (20)*	.048 (38)	-.115 (130)*
PERPUPIL	-.143 (188)*	-.163 (20)	-.012 (38)	-.150 (130)
CENT_OFF	-.157 (188)*	-.619 (20)*	-.204 (38)	-.076 (130)
TAX_LEVY	.365 (128)*	.588 (12)*	.262 (24)	.326 (92)*
BATT4	.787 (94)*	.611 (20)*	.702 (35)*	.884 (39)*
SSAI_1A	.640 (133)*	.621 (19)*	.354 (24)	.791 (90)*
SSAI_SA	.643 (133)*	.622 (19)*	.295 (24)	.779 (90)*
DROPOUT	-.157 (78)	-.771 (5)	.570 (6)	-.158 (67)
COLLPCT	.019 (188)	.000 (20)	.000 (38)	.010 (130)
EMP_RATE	-.003 (188)	.416 (20)	-.144 (38)	.029 (130)
ADA	.380 (188)*	-.123 (20)	.047 (38)	.372 (130)*
ADALG	.345 (188)*	-.070 (20)	-.006 (38)	.348 (130)*
BATT4N	.206 (94)	-.044 (20)	.380 (35)*	.110 (39)
BATT7N	.363 (188)*	-.107 (20)	.189 (38)	.336 (130)*
NGRADE	-.220 (188)*	-.166 (20)	-.212 (38)	-.077 (130)

* $p < .05$.

^aSmall schools contain approximately one class per grade.

^bMedium schools contain approximately two classes per grade.

^cLarge schools contain more than two classes per grade.

of all 4th grade schools) were not considered in this discussion. Thus, although Tables 8 and 9 were presented to give a complete description of the data set, some of the correlations were eliminated with respect to the following discussion of the relative merits of the predictors.

Context Variables: The school level context variables WHITEPCT and LUNCHPCT were significantly related to the criterion variable for each of the eight subgroups of 4th and 7th grade schools. With the exception of small 7th grade eligible schools, WHITEPCT and LUNCHPCT variables held the first two ranks in predictive power. Larger percentages of white students and smaller percentages of students on free or reduced lunch were associated with higher school achievement levels. Generally, LUNCHPCT was a somewhat more powerful context predictor than WHITEPCT; but the differences were slight. Although not tabled, these two variables, WHITEPCT and LUNCHPCT, as might be expected, were highly correlated ($-.860$ and $-.892$ for all 4th and 7th grade eligible schools, respectively). Therefore, the two variables shared predictive power. The fact that the correlations were generally higher for the school groups at the 7th grade level than the school groups at the 4th grade level may be related to the fact that variation in school means was larger in the 7th grade than in the 4th grade (the standard deviations were approximately one year and one-half year, respectively).

The district level context variables REVLG and SPARLG were also consistently significant, having achieved the 5% level of significance for seven of the eight 4th and 7th grade school subgroups. The signs of the correlations indicated that districts which provided higher

revenues and those which were more dense tended to contain schools which achieved at higher levels. Revenue (REVLG) was clearly a more accurate predictor than SPARLG, especially at Grade 4 where the correlations of REVLG with BATT4 were near .300. An exception occurred for small schools at the 4th grade where the correlation of .454 for REVLG and BATT4 was more powerful than for the other three 4th grade groups. Although maximally accounting for a relatively small amount of variation in the dependent variable (BATT4), REVLG was the third best predictor (including both context and input variables) at the 4th grade for three of the four eligible school groups with the medium-sized schools being excluded. At the 7th grade level, REVLG was the best context predictor for small schools ($r=.807$) although there were only 20 schools in this group. Additionally, REVLG was the third best context predictor for the all schools group ($r=.282$).

Input Variables: The results for the set of input variables indicated that the input variables which demonstrated the most consistency were those related to teacher salary. For teachers' salaries with educational levels at or above the bachelor's degree (T_SAL_2, T_SAL_3, T_SAL_4, T_SAL_5, and T_SAL_6), larger average district salaries were associated with higher achievement. This statement was also true for NI_SAL_T, the average salary for non-instructional staff in the district. T_SAL_2 was the fourth best predictor in the set at the 4th grade and third best at the 7th grade. However, caution should be exercised in the interpretation of these results since some of the correlations were based upon only a few cases.

Another teacher variable, educational level, apparently was not related to achievement for levels at the bachelor's degree and higher (T_ED_2, T_ED_3, T_ED_4, T_ED_5, and T_ED_6). Negative coefficients between BATT4 and the percentage of teachers with less than a bachelor's degree indicated that students in schools with larger percentages of such teachers achieved at a lower level than students in schools with smaller percentages of these teachers. This seemingly unusual finding may be related to the fact that districts with financial problems have difficulty attracting young teachers and may retain somewhat less qualified teachers in order to operate. However, the correlations which would support the preceding statement, while of the proper sign, were generally of modest size and nonsignificant. These correlations were not presented in this report. The relationship of teacher turnover rate (TURNOVER) and achievement was inconsistent across the school size groups, with the correlation being significantly negative for only small and large 7th grade schools.

For five of the eight groups of schools, the percentage of district administrators at the three highest educational levels (AD456) was positively associated with achievement. TAX_LEVY was positively related to achievement for six of the eight groups of schools; but, because of the fact that data for the TAX_LEVY variable were missing for approximately 30% of the schools, the TAX_LEVY variable was deleted from further analyses. Per pupil expenditure (PERPUPIL) was inconsistently related to achievement, the correlation being positive for all 4th grade eligible schools but negative for all 7th grade eligible schools.

The percentage of students in special education (SPECLG) was reasonably consistent in that five of the eight correlations were significantly negative. An examination of correlations (not presented) indicated that the SPECLG tapped some of the same factors as WHITEPCT and LUNCHPCT. The percentage of personnel in the district office (CENT_OFF) was inconsistent, being positively correlated with achievement for all 4th grade eligible schools and negatively correlated with achievement for all 7th grade eligible schools.

School size had as proxies ADALG and BATT4N or BATT7N. These variables were positively related to achievement for the all schools group at both 4th and 7th grade levels, indicating higher achievement levels in larger schools. Because of the stratification of each set of eligible schools based on average class size, the range of these two variables was severely restricted except for the groups of large schools in which considerable variation still existed. Additionally, student attendance (ATTENPCT) and participation in kindergarten (K_1STPCT) were not consistently related to achievement.

In summary, the best predictors were clearly the non-manipulable context variables WHITEPCT and LUNCHPCT which correlated with achievement consistently in the .600 to .800 range. REVENUE and SPARCITY were also consistently associated with achievement, but the correlations were much smaller.

Additionally, many input variables were correlated with achievement; and most of these correlations indicated relationships which agreed with intuition. However, these correlations were generally

quite small. The important question which needed to be considered before the relationships could be used as information for policy decisions involved the predictive power that the input variables provided beyond that associated with the context variables. This issue is addressed in the next section, "Partial Correlation Analyses".

Partial Correlation Analyses

The partial correlation analyses sought to determine which of the "promising" input variables continued to be associated with the criterion variable after the portion of variation attributed to association of these input variables with the context variables was removed. Input variables were identified as promising and were retained in the partial correlation analyses based on a statistical criterion. Significance of the zero-order correlations (Tables 8 and 9) for the all schools groups at a grade level was the primary factor used to identify promising input variables.

Of the variables whose correlations with the 4th grade criterion, BATT4, was significantly different from zero at the 5% level of significance, the following were selected for the higher order correlational analyses:

- a. the context variables WHITEPCT, LUNCHPCT, REVLG, and SPARLG; and
- b. the input variables ATTENPCT, SPECLG, K_1STPCT, TLG1, AD456, YRS_EXP, T_SAL_2, T_SAL_TL, NI_SAL_T, PERPUPIL, CENT_OFF, ADALG, and BATT4N.

This group of selected variables contained one member of every variable cluster of which at least one member correlated significantly with BATT4.

From the subset of variables which were correlated significantly with the 7th grade criterion (BATT7) at the 5% level of significance, the following were selected for higher order correlational analyses:

- a. the context variables WHITEPCT, LUNCHPCT, REVLG, and SPARLG; and
- b. the input variables SPECLG, K 1STPCT, TLG1, AD456, YRS_EXP, NOCSQ, T_SAL_2, T_SAL_TL, NI_SAL_T, PERPUPIL, CENT_OFF, ADALG, and BATT7N.

Before describing the results of the analyses, a brief section describing the process of "partialling" context variation from the input and criterion variables and the rationale for this process are presented.

The following argument is in support of the analyses of associations between input and criterion variables by examination of partial correlations. If independence existed among context and input variables, analyses of associations with the criterion variable would be simple and straightforward. Any simple correlation between a context or input variable and the criterion variable could be considered the result of some shared factor or factors which influenced no other context or input variable. Each correlation in such an analysis would answer the important question: "Do the context or input variable and the criterion variable share a unique source of variation?". In a more realistic world where variables are interdependent, dozens of

significant correlations between input or context variables and the criterion variable may stem from a unique source of variation. These dozens of correlations answer the posed question many times. To avoid such redundancy, an analytical approach must be selected which "partials out" common sources of variation, leaving sources which are unique to context or input and criterion variable pairs exposed to observation. The examination of partial correlations, from which presumably uncontrollable sources of variation (variation due to context variables) have been removed, permits observation of association stemming from sources of variation which may be controllable (variation attributable to input variables).

No one experienced in public education expects variables such as those in this study to be distributed independently of each other among schools. In addition, the variables in this study are not distributed independently among variable categories. Thus, input variables are correlated with context variables, as well as with each other within a category.

The study cannot investigate causality because of limitations in the study's design. Hypothetically, consider momentarily the percentage of white pupils and the percentage of pupils receiving free or reduced-price lunches as context variables, the amount of money available to the schools per pupil and the percentage of uncertified teachers as input variables, and the mean performance of pupils on a standardized achievement test as the criterion variable. Suppose that all five of these variables are strongly influenced by a single underlying factor,

socioeconomic status of the community. The two context variables are not subject to control by school officials; however, the input variables could be somewhat controlled by legislative and policy decisions. A study of the intercorrelations among these five variables shows that all of these variables are strongly associated.

Attention is restricted to the correlation between the input variable, the amount of money available to the schools per pupil, and the criterion variable. This correlation may arise from several sources which can be divided into two categories: (1) sources common to the input variable and the context variables and (2) sources unique to the input variable. Some of the association as measured by this correlation may stem from the differences in school socioeconomic status; some may come from the variation in policy or legislative decisions regarding the rate at which the community should be taxed. The former source of variation, school socioeconomic status, is probably not capable of change by school officials; the second source, tax rate, probably could be changed. The important question becomes: "How much association stems from sources of variation which can be manipulated?". Such a question is unanswerable in a study such as this, but information on the variables can be managed in order to at least address the question. First, all variation which the two context variables share with the criterion is systematically removed from the criterion. In other words, the criterion has been "residualized" on the context variables. Then the two input variables are residualized on the context variables; thus, there are two input residuals. Much of the effect of the underlying

socioeconomic factor would be expected to have been removed from the data. Moreover, effects of all other factors common to all five variables would be expected to have been minimized. No method exists to sort these common factors or identify them, but these factors no longer influence the input or criterion residuals.

Suppose the associations related to the input and criterion residuals are now studied. The two input residuals may or may not be correlated with the criterion residual. Either, neither, or both of the input residuals may share sources of variability with the criterion residual; but any association shared will be independent of the variation shared with the context variables. A significant correlation between the input and criterion residuals points to a new source of shared variation. Although the study cannot identify this common source, considerable insight ensues from the knowledge that the source is new and not merely a new look at an already observed effect (more specifically, the effect of the context variable). A correlation between residuals is a partial correlation. Since two context variables were "partialled out" of the criterion in the example, the correlation is a "second-order partial correlation".

A partial correlation analysis has two major disadvantages. The first major disadvantage is that some of the effects common to input and context variables may be somewhat capable of modification, but all effects are indiscriminately lost. The second disadvantage is that possibly, although unlikely, errors in the measures of the context, input, and criterion variables may be consistent in a manner which

causes too much variation, or the wrong variation, to be removed from the input and criterion residuals.

However, the analysis is not without considerable power. Context variables lie beyond the control of school officials because these variables stem from uncontrollable factors. As the effects of these factors disappear, hopefully manipulable effects common to input and criterion variables should emerge as significant second-order partial correlation coefficients.

Fourth-Order Partial Correlation Coefficients

In Tables 10 and 11, the correlation matrix among all residuals under consideration is presented. The residuals represent the portion of each measure which remains upon removal of shared context variation. As noted earlier, correlations between residuals are called "partial correlations". These tabled correlation coefficients are fourth-order partials since covariation attributable to the four context variables WHITEPCT, LUNCHPCT, REVLG, and SPARLG was removed. The top rows of each of these matrices are of primary interest in subsequent analyses since these rows display the fourth-order partial correlation coefficients between each of the selected input variables and the criterion.

Tables 12 and 13 concentrate on the fourth-order partial correlation coefficients with BATT4 and BATT7. In each table, the column headed "All Eligible Schools" repeats the first row of the appropriate partial correlation matrix from either Table 10 or 11. The other columns represent analyses within the eligible schools, subdivided by average estimated school size. For a set of eligible schools at

Table 10
All 4th Grade Eligible Schools^a
Fourth-Order Partial Correlation Matrix* for BATT4 and Fourteen Input Variables
after Adjustment for Shared Context Variation

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. BATT4	1.000	0.030	0.108	0.027	-0.083	-0.001	-0.156	-0.156	-0.086	0.003	0.066	0.134	0.090	0.267	0.002
2. SPECLG		1.000	0.136	-0.047	-0.120	0.033	-0.095	0.179	0.109	0.321	0.177	0.019	0.030	0.175	-0.020
3. K_1STPCT			1.000	-0.084	-0.025	0.054	-0.194	0.036	0.087	0.360	0.153	-0.009	-0.030	0.108	-0.005
4. TLG1				1.000	0.030	0.013	-0.142	-0.182	-0.172	-0.004	0.004	0.012	0.020	0.051	0.040
5. AD456					1.000	-0.062	0.009	0.100	0.088	-0.064	-0.087	0.060	0.028	-0.051	0.063
6. YRS_EXP						1.000	0.025	0.021	-0.110	-0.012	-0.082	-0.002	-0.033	0.131	0.041
7. T_SAL_2							1.000	0.377	0.188	0.092	-0.101	-0.066	-0.111	-0.106	0.062
8. T_SAL_TL								1.000	0.390	0.162	-0.022	-0.155	-0.150	-0.098	0.014
9. N_SAL_T									1.000	0.108	0.173	-0.076	-0.108	-0.136	0.020
10. PERPUPIL										1.000	0.131	-0.067	-0.078	-0.003	-0.008
11. CENT_OFF											1.000	-0.094	-0.128	-0.112	0.017
12. ADALG												1.000	0.726	0.031	0.021
13. BATT4N													1.000	0.032	-0.413
14. ATTENPCT														1.000	0.058
15. NGRADE															1.000

*p($\rho = 0$) < .05 if $|r| > 0.087$.
^an = 512.

Table 11
All 7th Grade Eligible Schools^a
Fourth-Order Partial Correlation Matrix* for BATT7 and Fourteen Input Variables
after Adjustment to Eliminate Shared Context Variation

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. BATT7	1.000	0.089	0.114	-0.084	-0.161	-0.002	-0.082	0.056	0.106	-0.052	0.060	0.091	0.097	0.083	-0.049
2. SPECLG		1.000	0.109	0.085	0.154	0.093	-0.111	-0.091	0.283	0.183	0.386	0.341	0.025	0.051	-0.011
3. K_1STPCT			1.000	-0.027	-0.182	0.058	-0.017	-0.071	0.064	0.025	0.534	0.044	0.080	0.111	-0.065
4. TLG1				1.000	0.110	0.037	0.054	-0.217	-0.248	-0.090	-0.047	0.119	-0.021	-0.004	0.083
5. AD456					1.000	-0.013	-0.117	0.062	0.126	0.007	-0.007	-0.126	0.058	0.000	0.153
6. YRS_EXP						1.000	-0.218	0.141	0.125	-0.149	0.017	-0.232	-0.164	-0.128	0.057
7. NOCSQ							1.000	-0.001	-0.123	0.080	0.041	0.088	0.012	0.017	-0.051
8. T_SAL_2								1.000	0.493	0.087	0.051	-0.134	-0.168	-0.106	-0.017
9. T_SAL_TL									1.000	0.333	0.333	0.012	-0.033	-0.049	-0.018
10. NI_SAL_T										1.000	0.259	0.176	0.112	-0.016	0.017
11. PERPUPIL											1.000	0.227	0.054	0.125	-0.094
12. CENT_OFF												1.000	-0.019	-0.032	0.064
13. ADALG													1.000	0.701	-0.328
14. BATT7N														1.000	-0.645
15. NGRADE															1.000

* $\rho(\rho = 0) < .05$ if $|r| > 0.144$.

^a $n = 188$.

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Table 12
4th Grade Eligible Schools
Fourth-Order Partial Correlation Coefficients of Selected Variables with BATT4
after Elimination of Variation Shared with Four Context Variables

Variable	Group of Schools			
	All Eligible Schools $\underline{n} = 512$	Small Eligible Schools ^a $\underline{n} = 61$	Medium Eligible Schools ^b $\underline{n} = 160$	Large Eligible Schools ^c $\underline{n} = 291$
SPECLG	0.030	-0.055	-0.042	0.103
K 1STPCT	0.108*	0.248	0.072	0.079
TLG1	0.027	-0.063	-0.048	0.044
AD456	-0.083	-0.191	-0.044	-0.090
YRS EXP	-0.001	-0.188	0.024	0.056
T SAL 2	-0.156*	-0.062	-0.058	-0.191*
T SAL TL	-0.156*	-0.291*	0.005	-0.174*
NT SAL T	0.086	-0.067	-0.052	-0.071
PERPUPIL	0.003	0.023	0.041	-0.030
CENT OFF	0.066	0.274*	0.000	0.100
ADALG	0.134*	-0.007	0.030	0.060
BATT4N	0.090*	-0.279*	-0.039	0.042
ATTENPCT	0.267*	0.216	0.191*	0.294*
Significant value of $ r $; $\rho = .05$	0.087	0.252	0.156	0.116

*Significantly different from 0 at 5% level of significance.

^aSmall schools contain approximately one class per grade level.

^bMedium schools contain approximately two classes per grade level.

^cLarge schools contain more than two classes per grade level.

Table 13
7th Grade Eligible Schools
Fourth-Order Partial Correlation Coefficients of Selected Variables with BATT7
after Elimination of Variation Shared with Four Context Variables

Variable	Group of Schools			
	All Eligible Schools $\underline{n} = 188$	Small Eligible Schools ^a $\underline{n} = 20$	Medium Eligible Schools ^b $\underline{n} = 38$	Large Eligible Schools ^c $\underline{n} = 130$
SPECLG	0.089	-0.516*	0.367*	0.120
K_1STPCT	0.111	0.239	-0.045	0.099
TLG1	-0.084	-0.464*	-0.422*	0.133
AD456	-0.161*	-0.241	0.265	-0.222*
YRS EXP	-0.002	-0.120	-0.015	-0.002
NOC5Q	-0.082	0.038	-0.074	-0.100
T_SAL_2	0.056	0.081	0.204	-0.012
T_SAL_TL	0.106	-0.241	0.361*	0.033
NT_SAL_T	-0.052	-0.140	0.032	-0.064
PERPUPIL	0.060	-0.199	0.311	0.039
CENT OFF	0.091	-0.312	0.104	0.120
ADALG	0.097	0.235	-0.242	0.099
BATT7H	0.083	0.103	0.177	0.049
Significant value of $ r $; $p = .05$	0.144	0.441	0.319	0.172

*Significantly different from 0 at 5% level of significance.

^aSmall schools contain approximately one class per grade level.

^bMedium schools contain approximately two classes per grade level.

^cLarge schools contain more than two classes per grade level.

either the 4th or the 7th grade, the same set of variables was studied within the three school size categories.

Two features in Tables 12 and 13 should be noted. The most important feature was the relatively small number of significant partial correlations. At the 4th grade level, zero-order correlations with BATT4 were significant for 12 of the 13 predictors for all eligible schools; however, only six fourth-order partial correlation coefficients were significant. For the 4th grade, the percent of significant correlations between predictor variables and the criterion variable dropped from 46% in all eligible 4th grade schools to an average of 18% in the three 4th grade school size groups. Therefore, the data suggest that most of the associations between input variables and the criterion variables as quantified by the zero-order correlation coefficients (see Tables 8 and 9) can be explained from the joint association of the input and criterion variables with the context variables.

The context variables were even more highly related to achievement at the 7th grade level than at the 4th grade level. Table 13 indicates that in the 7th grade one partial correlation coefficient was significant for the all eligible schools group and that six were significant for the other three subgroups. The fact that seven coefficients were significant for the four 7th grade analyses is hardly encouraging.

The second feature to note concerning these tables arises from a comparison of the significant fourth-order partial correlation coefficients with the zero-order correlation coefficients in Tables 8 and 9.

In many instances, one of two things occurred: either (1) the sign of the significant fourth-order coefficient was opposite the sign of the zero-order coefficient for the particular variable or (2) the zero-order coefficient was not significant for the particular variable. This phenomenon indicates that, when context variation is removed from the input and criterion variables, a rather different picture emerges.

Discussion of Grade 4 Correlation Coefficients: Table 12 indicates that partial correlations with the criterion BATT4 were significantly different from zero for ATTENPCT, T_SAL_2, T_SAL_TL, ADALG, K_1STPCT, and BATT4N. T_SAL_2 and T_SAL_TL were negatively correlated with the criterion BATT4; while ATTENPCT, ADALG, K_1STPCT, and BATT4N were positively correlated with the criterion BATT4. All of the fourth-order partial correlations were weak at the 4th grade level.

The positive correlation with ATTENPCT is consistent with the often reported finding that good attendance is associated with high achievement. Note that the fourth-order partial correlation coefficient is greater than the zero-order correlation coefficient for ATTENPCT. Seemingly, factors other than the willingness to attend school influence this input variable. Some of these factors are common to the context group; and, apparently, some of these factors partly cancel the effects of others. The moderate association between ATTENPCT and BATT4 which appears in the partial correlation coefficient of .267 is thus masked in the zero-order correlation. The following is offered as a tentative explanation. The simple correlations in Table 8 indicate that SPARCITY, while negatively correlated with ATTENPCT, was positively correlated

with BATT4. Apparently, a weak tendency exists for rural children to attend school at a higher rate but to achieve somewhat less than their urban peers. The conjecture was made that an underlying factor, call it "isolation", was common to all three variables. By "partialling out" SPARCITY, most of the effect of isolation on ATTENPCT and BATT4 was removed. Thus, the correlation between the residuals became more evident in the fourth-order correlation than in the simple correlation. This explanation served as an example only; many other interpretations are equally plausible. Although attempts to provide a posteriori explanations of these associations was a necessary part of this report, these explanations are fraught with danger. Insights into the interrelationships among the variables involved in this exploratory study may possibly suggest stronger confirmatory studies in the future in addition to some easily implemented policy modifications.

The two teacher salary variables, T_SAL_2 and T_SAL_TL, were negatively correlated with BATT4 in the partials, although the two variables were positively correlated when examined using simple correlation analysis. Each of the two teacher salary variables was more closely associated with each of the context variables, particularly SPARCITY and REVENUE, than with BATT4. Such a finding was anticipated since, in general, highly populated regions provide higher teacher compensation than rural areas and school districts with more revenue provide higher teacher salaries than districts with less revenue. When the effects of these two context variables, SPARCITY and REVENUE, were removed from the criterion and the salary variables, the residuals were negatively correlated, albeit weakly. Perhaps, the reversal in

the sign (negative relationship) was simply a product of the fact that most school officials who are often in charge of low-achieving schools and who wish to encourage increased student achievement feel that one way to obtain this goal is to raise teachers' salaries to attract and hold superior teachers. The current study, however, did not address the validity of such a feeling. Obvious, however, is the fact that, if low-achieving districts increased their budgets to pay their teachers higher salaries while high-achieving districts surrendered to the recession, the partial correlations between salary variables and achievement would remain negative. Should such decisions remain in effect for years and should achievement increase as a result of raising teachers' salaries, ultimately the sign of the partial correlation would probably change. Predictably, however, the decisions will not stay the same. When achievement levels become tolerable, salary increases will diminish; and, when achievement levels become intolerable, raises will be budgeted to make them tolerable again.

Although significant, the partial correlation between BATT4N and BATT4 was only .090. If a message lies in such an association, the message must read as follows: some of those factors which tend to cause the size of a grade to grow also tend to promote achievement, even when such an obvious set of factors as those common to SPARCITY is deprived of effect. The partial was less than the simple correlation because there was a weak positive association between BATT4N and several context variables and there was a weak positive correlation between these context variables and BATT4. Apparently, larger

schools were slightly better centers of learning, at least at the 4th grade level; and at least some of the gain was unrelated to factors common to the context variables. The argument in this paragraph serves to provide a tentative explanation for the partial correlation between ADALG and BATT4, as well.

The positive partial correlation between K_1STPCT and BATT4 reversed the weak negative correlation observed in the zero-order correlation which appears in Table 8. The simple correlations of K_1STPCT and the three context variables, WHITEPCT, SPARCITY, and REVENUE, were weakly negative. Thus, districts in wealthy urban areas with larger percentages of white pupils are expected to enroll a relatively smaller percentage of children in public kindergarten than poorer rural districts. This is probably partly because of the greater availability of private kindergartens and daycare centers in wealthy urban communities since private kindergarten and daycare enrollments did not appear in the measure of K_1STPCT. When the effect of the consistent tendency to patronize private kindergartens was systematically reduced by removal of the shared context variation, the partials showed the simpler association; many other factors being constant, kindergarten enrollments were positively associated with 4th grade achievement.

Of the three significant partials for those small schools with fewer than 35 pupils per grade, only two, CENT_OFF and BATT4N, needed to be addressed since earlier comments regarding teacher salary variables continued to be applicable. CENT_OFF was significant in the simple correlation for the all schools and medium school groups and

was significant in the fourth-order partial correlation with BATT4 only within the small school group. Thus, those remaining factors that that were not common to the context variables but which affected the relative size of the central office staff influenced achievement in the same direction, although weakly. The study of BATT4N was more rewarding. In the small-sized category, BATT4N became an excellent proxy for class size. The variable BATT4N was useless as such a proxy in the other two size categories. When the grade size fell below 35, the presumption that only one class constituted each grade seemed reasonable. Thus, BATT4N was the number of 4th graders taking the test; and these pupils were assumed to comprise one class. Note that the partial correlation coefficient of $-.279$ showed a weak negative association between BATT4 and the size of a class, many other factors being equal.

The significant partial correlations in the medium and large categories involved variables already addressed. These variables were ATTENPCT within the medium-sized schools and T_SAL_2, T_SAL_TL, and ATTENPCT within the large-sized schools.

Discussion of Grade 7 Correlation Coefficients: Among the partial correlations between BATT7 and the 7th grade variables, only AD456 was significant. For 7th grade schools, the context variables shared much more variance with the criterion variable than was true at the 4th grade. Removal of this variation by "partialling out" the context variables left rather depleted residuals; little variation was left to study associations among the variables. The negative partial of BATT7 with AD456 was explicable among several alternatives as follows: the same

sources of variation which promote the achievement of pupils serve to limit the hiring of administrators with advanced degrees. Districts with low-achieving pupils are favored in contests for competitive federal grants. Awards of such grants frequently result in the hiring of additional administrators in the district. A district whose achievement lags expectation also may seek subject matter specialists who augment the measure of AD456. Each of these factors or a combination of them could have produced the negative correlation revealed.

Both the set of small-sized eligible schools and the set of medium-sized eligible schools contained very few observations, 10.6% and 20.2% of the total number of observations, respectively. For the small-sized schools, the residuals of SPECLG and TLGI were negatively correlated with the residualized BATT7. The percentage of teachers without a bachelor's degree should be a proxy for district inability to meet or disregard certification standards; therefore, a negative correlation with achievement would be expected.

The negative correlation between BATT7 and SPECLG posed two problems: (1) What common source of variation could contribute to an increase in achievement simultaneous with a decrease in the percentage of handicapped pupils served?, and (2) Why does the source of variance act in this manner only in schools with one class per grade?. Although the correlation between SPECLG and BATT7 was significantly different from zero which was surprising, no ready explanation exists for this association.

Within the 38 medium-sized eligible schools, the message of the

partial correlations was consistent with many beliefs held by educators to a degree encountered in no other size group. Of the three significant correlations, SPECLG and T_SAL_TL were positive; and TLG1 was negative. These schools contained an average of 6.8 grades and served an average of 357 pupils per day. Eighty-seven percent of the schools contained 3rd and 4th grades, as well as 6th and 7th grades. For the most part, the students in these schools have been served continuously for at least four years before the students' achievement was measured. The enrollment was too high for the school to be typified as an isolated school. In such schools as these, factors which influence achievement had enough time to produce an effect within an otherwise stable school environment. In such schools, higher teacher salary and more attention to the special needs of handicapped pupils were associated with higher pupil achievement. The willingness to hire unqualified teachers (TLG1) was associated with lower pupil achievement.

For large eligible 7th grade schools, the partial correlations were very small. Only AD456 attained significance; AD456 was negatively associated with BATT7 and accounted for less than 5% of the residual variation in BATT7. Some of the possible factors which could produce such a negative partial correlation between achievement and the percentage of administrators holding advanced certificates have been discussed previously.

Regression Analyses

Stepwise regression procedures were used to select the set of

input variables which, in addition to the four context variables, contributed to the portion of variation in the criterion which were "explainable". In addition, commonality analyses, closely associated with partial correlation and stepwise regression, were performed. Although the results of the stepwise regression analyses were expected to closely parallel the results provided by the fourth-order partial correlation analyses, the stepwise regression should be responsive to residual relationships among the input variables as described in the matrix of fourth-order partial correlations. Thus, two significant partial correlations, even though residualized with respect to the context variables, may be related. If two significant partial correlations were related, only one of the variables would likely enter the stepwise regression equation; and, unless other nonstatistical factors were apparent, this variable would probably be the more important of the two for the purpose of policy recommendations. The second reason for performing the regression analyses is the possibility that different variables could be identified by the procedure. Since the regression analysis is somewhat more "demanding" of an input variable than the fourth-order partial correlation analysis, reducing the stringency of the statistical test by increasing the required significance level to 10% appeared to be reasonable. The final reason for including the stepwise regression analysis was to allow for the prediction of school means for the purpose of identifying outlier schools.

In the commonality analyses, the portions of variation in the criterion variable which were unique to the context set, unique to the

input set, and common to both sets were quantified. The results of the commonality analyses should support the earlier results and more clearly identify types of schools for which the likelihood would be greatest that average achievement could be modified. These two procedures, the stepwise regression analysis and the commonality analysis, were repeated for each of the eight subsets of schools which provided the structure for each analysis.

Context variables were "forced" into the prediction equation first so that the input variables selected for inclusion in the equation were chosen on the basis of fourth- and higher-order partial correlations with BATT4 or BATT7. Each input variable which was retained in the final regression model produced an increase in R^2 which was significant at the 10% level. The results of these eight stepwise runs are presented in Tables 14 and 15.

Table 14 contains the labels of the significant input variables and the standardized regression coefficients (beta weights) for all variables in the final equation. Raw score regression equations are presented in Appendix C. Since the four context variables were included in all models, significance of the contributions of the context variables was not an issue. Nonsignificant context variables are noted in Table 14. The signs of the standardized regression coefficients were indicative of the direction of the relationships and, for input variables, were generally the same as the signs of the corresponding fourth-order partial correlations. If the variables were independent, the magnitudes of the beta weights would signify the relative importance of

Table 14.

Standard Score Regression Equations for Predicting BATT4 (4th Grade) and BATT7 (7th Grade)
Using Four Context Variables and Significant Input Variables

School Group	n	Beta Weights Associated With Context Variables				Labels and Beta Weights for Significant Input Variables				
		WHITEPCT	LUNCHPCT	REVLG	SPARLG					
4th All	512	.202	-.580	.267	-.074	.183 ATTENPCT	-.078 T_SAL_TL	.083 ADALG	.067 CENT_OFF	-.089 T_SAL_2
4th Small	61	.723	-.173 (NS)	.465	-.347	-.261 T_SAL_TL	-.259 BATT4N	.261 ATTENPCT	.263 CENT_OFF	
4th Medium	160	.280	-.463	.127 (NS)	-.077 (NS)	.163 ATTENPCT				
4th Large	291	.045 (NS)	-.723	.238	-.044 (NS)	.193 ATTENPCT	-.143 T_SAL_2	.082 CENT_OFF	.060 ADALG	
7th All	188	.166	-.725	-.021 (NS)	-.067 (NS)	-.117 AD456	.104 T_SAL_TL			
7th Small	20	-.059 (NS)	-.397 (NS)	.523	.032 (NS)	-.275 SPEC LG				

Table 14 (continued)

Standard Score Regression Equations for Predicting BATT4 (4th Grade) and BATT7 (7th Grade)
Using Four Context Variables and Significant Input Variables

School Group	<u>n</u>	Beta Weights Associated With Context Variables				Labels and Beta Weights for Significant Input Variables	
		WHITEPCT	LUNCHPCT	REVLG	SPARLG		
7th Medium	38	.574	-.273 (NS)	-.074 (NS)	-.011 (NS)	-.233 TLG1	.198 SPEC LG
7th Large	130	.159 (NS)	-.774	.049 (NS)	-.062 (NS)	-.154 AD456	.093 TLG1

(NS) is used to indicate that the context variable was not significantly different from 0 at the 10% level.

Table 15

Commonality Analysis Associated with the Prediction of BATT4 (4th Grade) and BATT7 (7th Grade)
Using Four Context Variables and Significant Input Variables

School Group	<u>n</u>	Percent Variation in Criterion				Number of Significant Input Variables
		Unique to Context Set	Unique to Significant Input	Common	Total Set*	
4th Grade Total Eligible	512	46.3	4.8	11.8	62.9	5
4th Grade Small	61	56.3	17.2	-5.6	67.0	4
4th Grade Medium	160	53.5	1.8	-1.8	53.5	1
4th Grade Large	291	51.4	4.9	12.7	69.0	4
7th Grade Total Eligible	188	58.2	1.2	12.5	71.9	2
7th Grade Small	20	71.3	7.5	0.8	79.6	1
7th Grade Medium	38	60.6	9.9	2.7	73.2	2
7th Grade Large	130	72.8	2.1	0.5	75.4	2

*Values = $R^2 \times 100$.

the variables in the equation. Since this independence was not achieved, the variables were not directly comparable but were more informative than raw score coefficients which were affected by the scaling of the variables. The beta weights near zero, however, indicated that the variable was of little importance in the equation.

Table 15 indicates the percent of variation in the criterion variable uniquely associated with the significant input variable set and common to the two sets.

Discussion of Grade 4 Regression Analyses: From Table 14 for the total eligible sample of 4th grade schools, four of the six variables which had significant fourth-order partials were identified as being significant in the regression analysis, BATT4N was not significant, probably because BATT4N was highly correlated with the other school size measure, ADALG. Evidently, K_1STPCT was redundant with respect to these four variables; and CENT_OFF, although not significant based upon the partial correlation analysis, was included in the equation. In Table 15 the analysis of all eligible 4th grade schools indicated that, although five input variables were identified as significant, the joint unique contribution of these five input variables to the prediction of achievement was less than 5%. In addition to the three variables identified in the partial correlation analyses, ATTENPCT was also significant for small 4th grade schools. An interesting finding was that ADALG was directly related to achievement for all schools, while BATT4N was inversely related to achievement for small schools. This finding was not surprising since BATT4N was a proxy for average class size in small

schools; whereas, ADALG was a composite of average class size, number of classes per grade, and number of grades in the school. The four significant input variables accounted uniquely for 17% of the achievement variation which is by far the largest such value in the table. Of the three size groupings, the set of small schools was the only one for which the context variable SPARLG was significant. The implication is that for this set of small-sized schools, achievement scores tended to be largest for schools in less dense districts.

For middle-sized schools, only ATTENPCT was identified by the stepwise analyses as a useful input variable. Evidently, differences in 4th grade achievement for these schools was not related to the input variables included in the study since only about 53% of the variance of BATT4 was predictable.

The results for large 4th grade schools were very similar to those for the total set of 512 schools. Only T_SAL_TL, which was significant for all schools, did not enter the equation. Although large schools were "more predictable" than the total set (69% versus 63%), the commonality analyses pointed out that the primary reason for this was that achievement in large schools was more dependent upon the context factors (51% versus 46%).

Discussion of Grade 7 Regression Analyses: In addition to AD456 (the only significant fourth-order partial correlation), the stepwise analysis results for all eligible 7th grade schools included total teacher salary as a significant predictor. Total teacher salary carried a positive coefficient. Although achievement at the 7th grade level

appeared to be more closely associated with the context variable as a set (58% unique to context versus 46% for all 4th grade schools), the relationship was almost totally attributable to the two context variables, WHITEPCT and LUNCHPCT. For the other two context variables, only one of the eight coefficients was significant, the one associated with revenue for the small schools. Only about 1% of the achievement variance was uniquely associated with the input variables for the set of all eligible 7th grade schools.

Among the small 7th grade schools, SPECLG was the only significant input variable in the regression equation; however, SPECLG accounted for about 7% of the achievement variation. For this set of schools, the context variables and SPECLG were only moderately correlated; and the fourth-order partial of $-.516$ between BATT7 and SPECLG provided this 7% of additional predictive power. The significant negative partial correlation associated with TLG1 was not reproduced in the regression analysis. Although 71.3% of the criterion variation was predictable from the context variables, the only significant context variable was REVLG. WHITEPCT and LUNCHPCT, the two most powerful predictors in the data set as a whole, were not significant. Even though there were only 20 small-sized schools, this finding was quite unusual.

For medium-sized schools, SPECLG and TLG1 entered the equation and provided a unique improvement in predictability of about 10%. The sign of the beta weight for SPECLG was positive in contrast to the negative coefficient observed for small schools and for the zero-order correlation.

TLGI was inversely related to achievement, supporting the simple interpretation. Although T_SAL_TL had a significant positive fourth-order partial correlation with achievement, T_SAL_TL did not enter the regression equation. The sixty percent of the variation in achievement which was related to the context set was almost completely a function of the percentage of white pupils since the other three context variables were not significant.

For the large 7th grade schools, AD456 and TLGI entered the regression equation; but AD456 and TLGI accounted uniquely for only about 2% of the achievement variation. TLGI was directly related to achievement which was consonant with the sign of the nonsignificant fourth-order partial although reversed in sign from the zero-order coefficient. This set of 130 large schools was the "most predictable" set based upon the context variables, the unique association being approximately 73%. However, of the four context variables, LUNCHPCT was the only significant variable.

Following the procedures suggested by Kerlinger (1973), a cross-validation study was made to assess the extent to which computed values of R^2 within each size category were inflated because of "pseudo-association" among variables as a result of chance or error variation. The stepwise regression procedure took full advantage of associated random variation among variables entering the regression model. At times, such randomly associated error variation can contribute to R^2 , thus supporting the mistaken belief that too high a portion of the variation in the dependent variable has been "explained". The study commonly consists of four steps:

1. Available observations are separated into two subgroups, usually with half the observations in each. Refer to one group as the "original" sample and the other as the "cross-validation" sample.
2. Using some regression procedure, for example, stepwise regression, obtain the equation and compute R^2 for the original sample. Recall that this quantity likely overestimates the true association between the criterion variable and the predictors.
3. Use the regression equation from Step 2 to predict values of the criterion variable for the cross-validation sample. Calculate the correlation between these predicted values and the observed values of the criterion; the square of the correlation is the cross-validation R^2 .
4. If the R^2 values from Steps 2 and 3 are closely similar, conclude that chance plays a minor role in the assessment of R^2 . Combine the original and cross-validation samples and compute a final regression equation based upon the combination of the two samples.

The values of the squared multiple correlation (R^2) in the preceding discussion were based upon all available observations; therefore, the second part of Step 4 has been previously reported.

Within each size category, observations were subdivided into two equal subgroups by systematic sampling: odd observations became the original sample, and even observations became the cross-validation

sample. The small-sized 4th grade schools and the small- and medium-sized 7th grade schools contained too few observations for this procedure and were not considered. Estimates of R^2 in the original sample were computed, forcing into the regression model those variables selected by the earlier stepwise procedure on all observations combined. Table 16 reports these estimates for the original sample and the number of observations involved in the estimates. The regression equations were then applied to the observations in the cross-validation sample. The estimates of R^2 and the number of observations involved in the estimates also appear in Table 16. Note that the changes in R^2 from one sample to another were very small, increasing in three cases and decreasing in two as the original sample was replaced by the cross-validation sample. Chance played a small role in the estimate of R^2 , thus motivating Step 4. The estimate of R^2 for the combined samples, as well as for the number of observations in the combined sample, is reported in Table 16. Of interest is the finding that the R^2 estimate, based upon the combined sample, was between the estimates based upon the original and the cross-validation samples in each of the five instances examined.

Outlier Analyses

Once equations for predicting a school's achievement have been developed for a category of schools, the achievement predicted for a school may be compared with the school's measured achievement. This residual from the predicted value gives a better idea of the performance

Table 16
Cross-Validation Information for Selected School Groups

School Group	Half Sample (Original)		Half Sample (Cross-Validation)		Total Sample	
	$\underline{n}_1$	$\underline{R}^2$	$\underline{n}_2$	$\underline{R}^2$	$\underline{n}_3$	$\underline{R}^2$
4th All	256	.616	257	.635	512	.629
4th Med	80	.486	80	.567	160	.535
4th Large	146	.671	145	.704	291	.690
7th All	96	.745	96	.679	188	.719
7th Large	65	.799	66	.669	130	.754

NOTE: In some cases, $\underline{n}_1 + \underline{n}_2 > \underline{n}_3$, since $\underline{n}_2$ is the total number of even schools in each size category. None of the even schools was excluded because missing values which normally would cause exclusion were replaced with appropriate mean values of variables for that category before computation of $\underline{R}^2$ for even schools.

of the students in the school than actual mean achievement since the predicted value takes into account variables beyond the control of the school. Therefore, a school with low mean achievement but with a correspondingly low predicted value would have a residual near zero, indicating that the school's students are performing in an average fashion when district and school conditions are considered. Another school with lower than average achievement might actually have a positive residual, indicating better than average performance when compared with schools with similar conditions. Naturally, similar insights would be available to schools of average or above average actual performance.

In addition to the simple computation of residual mean school performance, the identification of schools with exceptional values for this residual was necessary. Such schools are referred to as "outliers".

The identification of outlier schools was based on the differences between measured achievement and predicted achievement. These achievement discrepancies were ordered from smallest to largest. Schools in the bottom 5% of this distribution, which indicated that measured achievement was far below predicted achievement, were designated as "negative outliers". Similarly, schools in the top 5% of the distribution were designated as "positive outliers".

The same eight size categories previously used in this report were studied individually. Considerable overlap was expected in schools identified as outliers within all 4th grade schools and those selected

in small, medium, and large 4th grade schools. Similar expectations applied to all eligible 7th grade schools and small, medium, and large 7th grade schools.

The results of the outlier analyses are not presented in this report. Instead, the results for each district will be made available to that district. District Outlier Summaries will be sent to districts requesting outlier analyses results.

Each District Outlier Summary includes predicted achievement, actual achievement, and the difference between these two values for each school in the district. Also included in the District Outlier Summary is the percentile rank of this difference with respect to all schools in the same grade level analysis and with respect to schools in the same grade and size stratum as the school. Schools identified as outliers are also noted in the District Outlier Summaries. A mock-up of a District Outlier Summary is presented in Appendix D.

CHAPTER IV

DISCUSSION, RECOMMENDATIONS, AND CONCLUSIONS

Introduction

The first section of this chapter presents a discussion of the results of the study. Also presented in this chapter are the recommendations and conclusions which are based upon the results of the study.

Discussion

Since the data have been viewed through various analyses and each of these analyses has been discussed to some extent independently, the focus of this section will be to synthesize the results. Before beginning a point by point discussion, however, a few comments regarding general difficulties with non-experimental studies and specific problems with this non-experimental study are discussed.

The notion of causality is fundamental to the scientific enterprise. If based upon sound (almost always experimental) research, scientific cause and effect statements virtually guarantee that, if one variable X is modified, a concomitant change in another variable Y will occur. Although identifying relationships between X and Y, non-experimental studies cannot guarantee that changes in X will result in corresponding changes in Y. Non-experimental studies only indicate that there is a relationship between the variables as the units upon which the measurements were made occur naturally. Thus, there is no guarantee

that results of this study, if translated into policy recommendations, will result in changes in the performance of students, either in a short period or over a long period of time.

An attempt was made in the analyses to make adjustments for context variables which were presumed to be beyond the control of school personnel. These context variables were "partialled" out of the correlation analyses and were "forced" into the regression equations. The large differences in the zero-order correlations and the fourth-order partial correlations support this approach. However, there are some disadvantages to this approach. The possibility exists that the partialling process overcorrected. That is, some of the variation in the criterion variables that was removed through association with the context variables may actually be effected by the input variables. The commonality analyses revealed that twelve percent and thirteen percent of the variation removed was common to the context and input variables for the 4th and 7th grades, respectively. An additional problem was the inability to adequately quantify a pure "ability" factor associated with financing a school district. Logic would suggest that only this ability factor should be included in the context set; therefore, financing associated with local "effort" seemingly should be included in the input variable set.

A further difficulty associated with this specific study was the gross differences in the level of aggregation for the variables included. The achievement test data were the most specific since these data were available for individual students in either the 4th or 7th grade in a school. However, the use of achievement for a single grade in a school

which may contain many grades presents obvious logical problems. Some of the predictor variables were aggregated at the school level and, therefore, could legitimately be referred to as school variables. Even though the two powerful context variables, WHITEPCT and LUNCHPCT, were included, school variables in this study were few in number. Although the values of the WHITEPCT and LUNCHPCT variables and the other school level variables were probably quite consistent across grade levels for most schools, such variables might not have been representative of the students in the specific grade tested for some schools. District level variables were further aggregated and were expected to be less useful in the prediction of the grade specific criterion variables. A discussion of the results of the various analyses follows.

Probably the most striking fact manifested in the data was the rather strong dependence of the school achievement test means on the context variables. In the 4th grade, roughly fifty percent of the criterion variation could be explained uniquely by the context variable set. In the 7th grade, approximately sixty percent of the criterion variation could be explained uniquely by the context variable set. On the other hand, the input variable set predicted only 5% and 1% of the criterion variation uniquely in the 4th and 7th grades, respectively. These figures were based on the analyses for the all schools group at each grade level.

Thus, the major result of this study was that a large amount of achievement variation was associated with the few non-manipulable context variables and very little achievement variation was related to the rather extensive set of presumably manipulable input variables.

How should these discouraging results be interpreted? Do these results mean that student kindergarten attendance, school personnel preparation and experience, school personnel salaries, etc., make very little difference? Intuitively, the answer to the latter question appears to be in a negative direction. However, a more in-depth investigation would be necessary in order to identify definitive critical variables which would lead to potentially useful modifications in the educational enterprise.

Although teacher effects have been difficult to isolate, the contention is that analysis of the data at the classroom level would have a greater potential to uncover factors which are educationally important. Since classroom organization and teacher assignments are modifiable areas, the identification of factors related to achievement such as classroom racial balance, variation in ability, class size, and characteristics of the classroom teacher would be extremely useful information for analysis purposes. Although surely not as powerful as variables describing the dynamics of the classroom teaching-learning situation, the utilization of readily available classroom level data would be an improvement in the study design.

Although the results of this study indicated that the input variables were only weakly related to achievement, the relationships between a few input variables and achievement should be interpreted cautiously. In several analyses at the 4th grade level, school attendance was consistently positively related to achievement. School attendance was the only variable which occurred consistently across all four analyses within a grade level; and, therefore, this result appears to be the most

reliable and general.

School size as operationalized by average daily attendance was also positively related to achievement for the analysis of all 4th grade schools. Since the variation in school size was greatly curtailed by the stratification process, the fact that this variable was not significant for the sub-analyses of small- and medium-sized schools was not surprising. On the other hand, the class size variable at the 4th grade level in the subset of small schools appeared to be negatively related to achievement. The significant correlations between school size and achievement and between class size and achievement support the inference that larger schools and smaller classes tend to foster greater achievement at the 4th grade level.

The percent of staff in the district central office was also consistently positively related to achievement. This result could be a reflection of the availability of federal funds. The fact that teacher salary indicators were consistently negatively related to achievement at the 4th grade was a surprising finding. This finding may reflect a lag in a dynamic system in which salaries are increased in response to low achievement. Another possible explanation is that, if a district allocates a larger percentage of its income to teacher salaries, the portion remaining for other expenditures, such as instructional supplies and materials, is necessarily reduced.

In the 7th grade, the most commonly occurring input predictor was the percent of teachers with less than a bachelor's degree. Although not a significant predictor for the analysis of the all eligible schools group,

this variable did appear in each of the sub-analyses by school size; however, the relationship between this variable and achievement was not consistent for the three school size groups. For small- and medium-sized schools, smaller percentages of teachers with less than a bachelor's degree were significantly related to higher achievement (negative relationship). Although not significant, smaller percentages of teachers with less than a bachelor's degree were related to lower achievement in the large-sized schools (positive relationship). The two negative relationships are consistent with the explanation that more qualified teachers (those with at least a bachelor's degree) should foster higher achievement in the students that these teachers instruct; an explanation of the positive coefficient is not so simple. The fact that the percent of teachers with less than a bachelor's degree was not significant in the partial correlation analyses and was (non-significantly) negative in the zero-order correlations indicates that this variable was operating as a suppressor of some variable previously included in the equation. Since the percent of students on free or reduced lunch was the only significant context variable and the fourth-order partial was negative, the possibility exists that the percent of teachers with less than a bachelor's degree was suppressing the percent of students on free or reduced lunch. No reasonable substantive explanation of this result was apparent.

Teacher salary variables entered as significant positive predictors in two of the analyses. The data indicated that teacher salary was positively related to student achievement at the 7th grade level but

that teacher salary was negatively related to student achievement at the 4th grade level. At the 4th grade level, the relationship among the analyses by school size was much more consistent than at the 7th grade level.

A negative relationship between the percent of administrators at the three highest educational levels and achievement was obtained for the 7th grade in the all schools group and the large schools group which numerically dominated the total set of 7th grade schools. No compelling explanation of this result is available although a possibility was suggested in Chapter III of this report.

The percentage of students in special education classes was an inconsistent predictor in the 7th grade. This variable was negatively correlated with achievement for small-sized schools and positively correlated with achievement for medium-sized schools.

An interesting observation was the fact that, for the group of medium-sized 7th grade schools, the results for the three significant input variables were consistent with traditional expectations concerning how these variables should relate to achievement. The argument is that, in these schools more than any school size group, school effects would have had an opportunity to function for a reasonable period of time since most of these schools (87%) have organizational structures which extend down to the 3rd grade. If school effects are real, then the assumption that school effects operate in a cumulative manner, over a period of several years rather than over a one year period, should be made. Therefore, the arbitrarily selected eligibility criterion used in this study,

that is, the school must include one grade below the grade tested, may not be realistic and may need to be reconsidered.

Recommendations

This section is organized in three parts as follows: (1) a discussion of variables which should be added, deleted, or modified in future Indicators of Educational Quality studies; (2) a list of suggested design modifications for future studies; and (3) a proposal for assessing relevant classroom variables to study the impact of these variables upon achievement.

Suggested Variable Changes

A necessary and substantive change would be to move the variable REVENUE, now classified as a context variable, into the set of input variables, and replace the REVENUE variable in the context variable set with an additional variable. REVENUE as presently defined contains information reflecting at least two factors, namely, district ability and district effort to provide money to operate the district's schools. Context variables should be as free as possible from sources of variability related to effort or will. The variable REVENUE, then, should be moved into the set of input variables. A new variable, district assessed valuation per pupil, available from the Annual Report of the State Superintendent of Education, should replace REVENUE within the set of context variables. A variable such as district assessed valuation per pupil, previously untrustworthy because of differing assessment policies among the State's counties, becomes quite sound as a result of the statewide uniform assessment mandated by the Legislature.

Existing clusters of variables should be operationalized differently. An example of such a cluster is the set of variables T_SAL_1, T_SAL_2, T_SAL_3, T_SAL_4, T_SAL_5, T_SAL_6, and T_SAL_TL. These measures are confounded and redundant; the unique contribution of each variable is miniscule. In addition to the redundancy of each measure within the cluster, each measure reflects a composite of effects such as base pay for new teachers, advanced degree salary increments, and longevity salary increments. Thus, the seven variable cluster should be replaced with indicators of these three salary factors. These three salary indicators should be based upon the district's salary schedule for teachers and should be measured at the district level. The three variables should be:

1. base salary for a bachelor's degree with no teaching experience;
2. the degree increment for graduate study from the bachelor's degree to the master's degree with no years of experience; and
3. the longevity increment for the first five years at the bachelor's degree.

Although these recommendations seem arbitrary, they actually reflect factors which policymakers consider in setting salary scales: attractiveness of salary to new teachers, influence on encouraging teachers to pursue advanced study, and teacher experience. Although a year out of date when published, values for these three variables are available in Local Supplements in South Carolina Schools, 1975-76, compiled by the South Carolina Education Association. However, if a more current document was not available, these figures would suffice since the figures appear to be rather consistent from year to year.

The variable TAX_LEVY was available in insufficient numbers to merit its inclusion in the regression analyses; its presence would have considerably reduced the sample size. Since these data are readily available for each district (see the Annual Report of the State Superintendent of Education), more careful development of working data tapes is required to assure complete data for this variable. Once the state-wide uniform assessment program becomes stable, TAX_LEVY will be an excellent measure of local effort to provide funds for schools. After the removal of shared context variation, the partial correlation of TAX_LEVY with REVENUE should be quite high and should provide a rough test of the extent to which removal of context variation removes only the ability to provide funds for schools.

Many variables in the study were measured at the district level, and others were measured within specific schools. Most of the variables which were measured at the district level were unavailable at the school level; indeed, many of these variables were invariant among schools within a district. Such was not the case with the important context variable, SPARCITY. This variable, measured at the district level, was usually a source of variation among schools; such variation was unreflected by any measure in the study. SPARCITY, actually a measure of pupil density per unit of school attendance area, should be renamed to aid conceptualization of the variable. Also, SPARCITY should be measured at the school level. Instead of computing the SPARCITY variable by dividing ADA by school attendance area, the numerator should be "average pupils per grade". Otherwise, the number

of grades within a school will influence the measure, making SPARCITY untrustworthy as a measure of geographic isolation of a student from his classmates. A problem arises with respect to determining the surface area of a school attendance zone; such measures are not readily available. District test coordinators could be trained to derive such a measure at a Statewide Testing Program Pretest Workshop, and measures could be collected from coordinators during a posttest workshop. Should such a variable be impossible to acquire, each principal could typify his school population as "rural", "urban", or "mixed rural-urban", since such a measure would probably improve considerably the current measure of SPARCITY. If possible, the trichotomous measure of density (SPARCITY) could be collected on the annual BEDS forms.

In addition to the variables above, several new variables are recommended for subsequent Indicators of Educational Quality studies. The first recommended and the easiest variable to obtain is the simple difference of PERPUPIL and REVENUE which would consist of the "per pupil" allocation for public education in a district from State and federal sources. State contributions are awarded based upon the number of pupils served and should be satisfactorily constant from district to district when expressed on a per pupil basis. Although local per pupil expenditure may be less than REVENUE, variation in the measure would come primarily from the federal contribution to the district and could prove useful in predicting several criterion measures, including achievement.

Total school expenditures for instructional material and equipment are available in the BEDS file. Considering the negative relationships

obtained between teacher salary variables and achievement, the implication was that some school districts possibly increase teacher salaries at the expense of providing adequate funds for instructional materials and equipment. The recommendation is to include this variable as a school level variable on a per pupil basis.

Another easily obtained new measure is the percentage of pupils tested for achievement in each school who attended either a public or private kindergarten. This percentage could be obtained from special codes on student answer forms utilized in the Statewide Testing Program. Such a measure would be more precise than the current study's K_1STPCT variable and probably would draw part of its variation from sources other than K_1STPCT. The recommendation, then, is to retain K_1STPCT and to add a new variable for each grade level tested.

Also readily available are several new variables which were added to the current study during analysis: average daily attendance, school grade organization, and the number of students per school with achievement scores available at each grade level of the testing. These variables, previously discussed in this report, should be assimilated early into a subsequent study's data set.

A useful variable which would be a candidate for the set of context variables is district Title I allocation, available from the Office of Federal Programs within the Department of Education. This variable is based on the number of people at various income levels, family sizes, number of family members who are handicapped, foster children within a district, inter alia. If divided by ADA, district Title I allocation could be the soundest available measure of socioeconomic status within

a district.

Also of considerable utility would be the schoolwide expenditure per pupil from federal funds, principally Title I of ESEA (Public Law 89-10, as amended). Although not currently available within district offices, this measure will be available subsequent to the installation of new accounting procedures currently 30% installed in South Carolina school districts. The change to the new system should be complete by the end of fiscal year 1978.

A need exists for a new variable to measure average class size within a school. Certain trends in the data for the current study imply that large grades and small classes are related to achievement, but available proxies for average class size are generally too clumsy to be useful. Moreover, since large grades tend to result in large classes, these two effects could tend to cancel each other's impact on the criterion, leading to a reduction in the simple correlation between either measure and the criterion. These variables' partial correlations might reveal different results; therefore, such analyses would demand good measures.

A measure of the mean chronological age of pupils participating in the Statewide Testing Program is available by school from the research tapes provided by the test scoring agency. Such a measure should vary depending upon the district's rate of pupil failure in a given grade. With context variation removed, this measure should reflect school policy regarding failure and could be a useful correlate to achievement.

These additions, deletions, and modifications of variables would substantially improve subsequent Indicators of Educational Quality studies.

Possible Design Modifications

The previous discussion was related to the fact that some variables are measured at the district level, while others are measured at the school level. Virtually, every grade organization conceivable is present in South Carolina school districts. Many schools have no grade lower than 4th grade, while others have no grade lower than 7th grade. The presumption of a measurable effect on pupil achievement by school factors within the first one and one-half months of a pupil's attendance in that school seemed totally unfounded, forcing the exclusion of such schools from the analyses as discussed earlier (see the "Sample Section" of Chapter II in the explanation of the "eligibility" criterion for the sample selection). Such exclusion did not solve the problem entirely. Still, some pupils had been enrolled in their schools three years prior to testing; while others had been enrolled in their schools for only one or two years. If the assumptions are made that school variables produce an effect on achievement and that achievement occurs slowly over time, then time in school should be an important consideration in the amount of effect these factors produce. Ideally, these factors should be considered in a context where time in school is constant for all observations. Thus, assuming that input variables effectively influence achievement, a pupil's achievement may have been influenced positively by the district, positively by the two-grade primary school this pupil attended, and negatively by the current elementary school where this pupil had been enrolled one year. To relate this pupil's achievement to school variables in the current

school is rather illogical unless the assumption is made that the present school "undid" all the positive effects of the former school and worked its full negative effect in a single year. If the analysis should include a set of school variables for the pupil's first, second, and third school years, the number of variables would greatly increase the already overpowering set of study variables. Then, too, the variety of feeder systems by which one school's output of pupils becomes a partial input of one or more other schools would increase the complexity of such analyses almost beyond comprehension.

One shortcut to this analysis problem would be to select for analysis purposes only schools in which the pupils tested have attended for the pupils' complete school careers. Such schools are in short supply for pupils tested at 4th grade; the number of these schools diminishes drastically for pupils tested at 7th grade and virtually disappears for pupils tested at any higher grade. Analyses of regression with a large number of variables require many more observations than variables, at least seven times as many and preferably 20 times as many; therefore, sufficient observations for such analyses are not available.

Another approach would be to perform regression analyses in which the observations are not schools but school districts. Thus, all school level data would be aggregated to reflect district conditions. Only 92 observations would exist since there are 92 school districts in South Carolina. The small number of observations would reduce the number of variables which could enter the regression equation to a maximum of 13. The aggregation process would eliminate most of the variation

in the measures and little variation would remain for analyses. Such a plan for the analyses is, therefore, not strongly recommended.

An ideal approach to the study of relationships between the indicators of school quality and achievement, or other criterion variables, is a longitudinal study. Such an approach would require that the same pupils be tested several times, usually at one-year intervals. Although costly in terms of time and money, a longitudinal study would provide far better statistical control of the variables involved. A longitudinal study of all public school pupils in South Carolina would be unnecessary: a sample of schools could be selected and then followed closely to assure the generation of essential data.

A quasi-longitudinal study could be implemented in future Indicators of Educational Quality studies. Achievement data will be available for both 3rd and 6th grade pupils through the 1976-77 Statewide Testing Program. For these schools, the 3rd grade achievement would be considered a measure of pupil entry characteristics with respect to 6th grade achievement. The increase in achievement from Grade 3 to Grade 6 could then be related to the Indicators of Educational Quality based on the assumption underlying the current study, that these indicators are linearly related to achievement gains. Such an approach would be far more precise than those used in the current study. However, very few schools contain both a 4th and a 7th grade, the two grades which furnished achievement data for the current study. This small number of schools makes the analyses suggested for a future study impossible at present.

Finally, one primary difficulty with an exploratory study such as this Indicators of Educational Quality study was its atheoretical nature. The goal of this study was simply to identify relationships. A similar study, guided by hypotheses, fed by variables each of which should respond primarily to a single source of variation presumably related to achievement, and rendered logical by a theoretical framework, would achieve a more precise and direct purpose. Although requiring extensive time, an effort should be made to create theoretical models to be tested for validity by successive studies of the Indicators of Educational Quality. An extensive literature review would be required in order to facilitate this theoretical approach.

Proposal for Assessing Relevant Classroom Variables

Many sources of variation generally believed to be related to achievement are located within individual classrooms and were left unsampled in the current study. The collection of measures on variables influenced by these untapped sources would require the aggregation of data at the classroom level rather than at the school or district level. Since the achievement measures used in the current study were composites of reading, language, and mathematics achievement and since many schools use different teachers for each of these three skill areas, an approach relating achievement to teacher variables could be implemented. For example, if reading achievement were used as the criterion, the environment of the classrooms in which the students were taught reading and the characteristics of the reading teacher would be the area of concentration.

Some teacher characteristics that would be of interest are the following:

1. verbal ability,
2. reinforcement strategy,
3. age,
4. sex,
5. race,
6. years of teaching experience,
7. years in current position,
8. highest degree,
9. parochialism, and
10. reading certification status.

Most of these variables are easily operationalized. Verbal ability is a major component of a teacher's score on the Commons Subtest of the National Teacher's Examination. "Parochialism" refers to whether the teacher grew up, was educated, and teaches within the same district or county. The "parochialism" variable could be dichotomous. A "0" could mean that a particular teacher grew up and teaches within the same district or county and attended a college or university within 200 miles of the teacher's home. If the teacher either grew up elsewhere or obtained teacher training at a remote institution or both, the variable would be coded "1". The reading certification status could also be dichotomous: the teacher does or does not hold a valid teaching certificate in the area of reading.

Various classroom variables that would be of interest, if they could be measured, are the following:

1. class size;
2. type of teaching (open classroom, team teaching, self-contained, departmentalized, etc.);
3. average minutes per week spent on reading;
4. basic reading approach (phonics, "see-say", linguistic, eclectic);
5. basal text or primary teaching system;
6. pupil grouping strategy (small homogeneous ability groups, small random groups, small compatible groups, small self-selected peer groups, small teacher-selected peer groups, whole-class groups, etc.);
7. average time per week for each pupil under direct instruction by teacher;
8. average pupil time "on task"; and
9. percentage of class time per week spent on administrative tasks, instructional tasks, and correction of behavioral problems and percentage of time lost because of changes of activities, pupil movement, "settling-down," etc..

Most of these measures would require an external observer in the classroom and are consequently expensive and time consuming.

Conclusions

Although probably viewed negatively, the most compelling conclusion which can be drawn from the various analyses presented in this study is that, if useful results are to be generated from a future study, modifications in design will be required. Although input variables such as student attendance, teacher degree status and teacher salary, school size and class size, and a few others were identified as being

related to cognitive performance at certain grade levels, the relationships were minimal in comparison to those dealing with the more dominant context variables. The racial composition and social status of the students attending a school were the most powerful predictors of school mean achievement in the analyses. Very little residual association was identified which could be attributed to presumably manipulable input variables. The thesis of this research is that, if manipulable factors which relate to student achievement are to be identified, a more refined approach is required. This approach would take into account differential levels of data aggregation, the length of time the school has had to affect student performance, specifics of the classroom-learning environment, and the characteristics of the teacher fostering the classroom learning. Additionally, modifications in the operationalization and selection of variables is needed. Many suggestions as to how future studies might improve upon the present one were outlined in the Recommendations Section of this chapter.

A study such as this should be carried out on a regular basis. The anticipation is that, as experience is gained, the results will prove to be more useful both to educators in general and to local educational policymakers.

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APPENDIX A
Mock-up of District Profile Report
and
Definitions of the Study Variables

SOUTH CAROLINA DEPARTMENT OF EDUCATION

OFFICE OF RESEARCH

SEPTEMBER 1976

COUNTY Y DISTRICT X

PAGE 1

CALCULATIONS THAT USE 180-DAY ENROLLMENT DO NOT INCLUDE SPECIAL EDUCATION STUDENTS

100273

CONTEXT INDICATORS

		RANGE FOR STATE			
CONTEXT		DISTRICT	STATE	HIGH	LOW
	1. RACIAL COMPOSITION OF STUDENT POPULATION (1974-75 180-DAY ENROLLMENT FOR GRADES 1-12 PLUS UNGRADED.)				
	NONWHITE	48%	40%	100%	8%
	WHITE	52%	60%	92%	0%
CONTEXT	2. STUDENTS RECEIVING A FREE OR REDUCED LUNCH (DAILY AVERAGE OF FREE OR REDUCED LUNCHES FOR SEPTEMBER, 1975 AS A PERCENTAGE OF ADA FOR CAFETERIA SERVING)	57%	44%	96%	6%
CONTEXT	3. LOCAL REVENUE PER PUPIL (LOCAL REVENUE FOR 1974-75 DIVIDED BY THE 180-DAY ADA, 1974-75. LOCAL REVENUE WAS OBTAINED FROM THE TOTAL RECEIPTS-YEAR ENDING JUNE 30, 1975, -- ANNUAL REPORT OF THE STATE SUPERINTENDENT, 1974-75 -- EXCLUDING ACCOUNT 11-12, LEVIES FOR DEBT SERVICES. INCLUDES A PRO RATA SHARE OF COUNTY BOARD RECEIPTS AND AREA VOCATIONAL CENTER RECEIPTS AS APPLICABLE.)	\$160	\$279	\$723	\$84
CONTEXT	4. SPARSITY INDEX (TOTAL PUPILS IN ADA FOR THE 180-DAY PERIOD DIVIDED BY THE SQUARE LAND MILES IN DISTRICT)	9	18	197	4

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COUNTY Y DISTRICT X

100274

INPUT INDICATORS

RANGE FOR STATE

		DISTRICT	STATE	HIGH	LOW
INPUT	1. ELIGIBLE STUDENTS ENROLLED IN KINDERGARTEN PROGRAM (KINDERGARTEN ENROLLMENT DIVIDED BY FIRST GRADE ENROLLMENT: BOTH ENROLLMENT FIGURES BASED ON 1974-75 180-DAY ENROLLMENT)	88%	53%	127%	15%
INPUT	2. ENROLLMENT BY HANDICAPPING CONDITION AS PERCENTAGE OF TOTAL ENROLLMENT (1974-75 ADM BY HANDICAPPING CATEGORY DIVIDED BY ADM FOR GRADES 1-12)				
	EDUCABLE MENTALLY HANDICAPPED	5.3%	0.1%	8.6%	0.0%
	TRAINABLE MENTALLY HANDICAPPED	0.7%	0.2%	1.4%	0.0%
	EMOTIONALLY HANDICAPPED	0.0%	0.1%	1.6%	0.0%
	VISUALLY HANDICAPPED	0.0%	0.0%	0.0%	0.0%
	HEARING HANDICAPPED	0.0%	0.0%	0.1%	0.0%
	ORTHOPEDICALLY HANDICAPPED	0.0%	0.0%	0.5%	0.0%
	LEARNING DISABILITIES	0.0%	0.1%	0.5%	0.0%
INPUT	3. ADA AS PERCENTAGE OF ADM (180-DAY, 1974-75)				
	ELEMENTARY	97%	94%	99%	89%
	SECONDARY	94%	93%	98%	84%
INPUT	4. STUDENT TEACHER RATIO FOR THE ELEMENTARY SCHOOL LEVEL (1974-75 180-DAY ENROLLMENT EXCLUDING SPECIAL EDUCATION STUDENTS DIVIDED BY THE NUMBER OF TEACHERS, BEDS, 1974-75 FOR PERSONNEL CLASSIFIED AS CLASSROOM TEACHER AND OTHER PROFESSIONAL INSTRUCTIONAL-ORIENTED STAFF)	17	22	27	17

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COUNTY Y DISTRICT X

100275

INPUT INDICATORS

RANGE FOR STATE

		DISTRICT	STATE	HIGH	LOW
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INPUT 5. AVERAGE CLASS SIZE FOR SUBJECTS REQUIRED FOR GRADUATION BY THE DEFINED MINIMUM PROGRAM
(THE SUM OF STUDENTS REPORTED IN 1974-75 BEDS AREAS INDICATED BELOW DIVIDED BY THE TOTAL
NUMBER OF DIFFERENT CLASSES IN EACH AREA)

ENGLISH	22	25	37	16
MATH	22	25	41	15
HISTORY	22	26	33	15
SCIENCE	20	26	33	14

INPUT 6. LEVEL OF TEACHERS EDUCATION (1974-75 BEDS FOR PERSONNEL CLASSIFIED AS SPECIAL EDUCATION
(SELF-CONTAINED), SPECIAL EDUCATION (RESOURCE), CLASSROOM TEACHER, OTHER PROFESSIONAL
INSTRUCTIONAL-ORIENTED STAFF)

ELEMENTARY

LESS THAN BACHELOR DEGREE	2%	4%	18%	0%
BACHELOR DEGREE	42%	42%	81%	30%
BACHELOR DEGREE PLUS 18 HOURS	42%	22%	47%	7%
MASTERS DEGREE	14%	31%	37%	0%
SIX-YEAR CERTIFICATE	0%	1%	4%	0%
DOCTORS DEGREE	0%	0%	2%	0%

SECONDARY

LESS THAN BACHELOR DEGREE	7%	1%	30%	0%
BACHELOR DEGREE	33%	53%	83%	19%
BACHELOR DEGREE PLUS 18 HOURS	20%	27%	42%	6%

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COUNTY Y DISTRICT X

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INPUT INDICATORS

INPUT 6. (CONTINUED)

RANGE FOR STATE

DISTRICT STATE HIGH LOW

SECONDARY

MASTERS DEGREE	40%	19%	61%	0%
SIX-YEAR CERTIFICATE	0%	0%	4%	0%
DOCTORS DEGREE	0%	0%	3%	0%

INPUT 7. LEVEL OF ADMINISTRATORS EDUCATION (BEDS, 1974-75 FOR PERSONNEL CLASSIFIED IN THE CATEGORIES OF SUPERINTENDENT, SUPERVISOR, DIRECTOR, CONSULTANT, COORDINATOR, OR PRINCIPAL)

LESS THAN BACHELOR DEGREE	0%	1%	29%	0%
BACHELOR DEGREE	0%	6%	29%	0%
BACHELOR DEGREE PLUS 18 HOURS	25%	9%	43%	0%
MASTERS DEGREE	75%	74%	100%	29%
SIX-YEAR CERTIFICATE	0%	7%	33%	0%
DOCTORS DEGREE	0%	3%	17%	0%

INPUT 8. AVERAGE YEARS EXPERIENCE IN EDUCATION FOR SCHOOL PROFESSIONAL PERSONNEL (BEDS, 1974-75 FOR PERSONNEL CLASSIFIED AS SPECIAL EDUCATION (SELF-CONTAINED), SPECIAL EDUCATION (RESOURCE), CLASSROOM TEACHER, OTHER PROFESSIONAL INSTRUCTIONAL STAFF, LIBRARIAN, GUIDANCE COUNSELOR, OTHER PROFESSIONAL INSTRUCTIONAL-ORIENTED STAFF)

ELEMENTARY	13	11	20	4
SECONDARY	13	11	25	6

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COUNTY Y DISTRICT X

100277

INPUT INDICATORS

RANGE FOR STATE

INPUT			DISTRICT	STATE	HIGH	LOW
INPUT	9. INSTRUCTIONAL TIME SPENT BY PROFESSIONALS OUT OF THEIR AREA OF CERTIFICATION (BEDS, 1974-75 FOR PERSONNEL CLASSIFIED AS SPECIAL EDUCATION TEACHER (SELF-CONTAINED), SPECIAL EDUCATION TEACHER (RESOURCE), CLASSROOM TEACHER, OTHER PROFESSIONAL INSTRUCTIONAL-ORIENTED STAFF)					
		ELEMENTARY	18%	14%	41%	0%
		SECONDARY	2%	13%	37%	0%
INPUT	10. TEACHER TURNOVER RATE: ONLY TEACHERS REQUIRING CERTIFICATION ARE INCLUDED IN THIS FIGURE. THESE TEACHERS ARE IDENTIFIED ON THE BASIS OF THE FOLLOWING CRITERIA: 1) THEY WERE EMPLOYED FOR AT LEAST 100 DAYS AND TEACHING AT LEAST 180 MINUTES PER DAY. 2) THEY WERE TEACHERS OF GRADES 1-12, SPECIAL EDUCATION CLASSES, OR UNGRADED CLASSES.					
		ELEMENTARY	14%	19%	38%	2%
		SECONDARY	11%	19%	42%	4%
INPUT	11. CENTRAL OFFICE STAFF REQUIRING CERTIFICATION AS A PERCENT OF DISTRICT PERSONNEL REQUIRING CERTIFICATION (BEDS, 1974-75 INCLUDING ALL SCHOOL PERSONNEL AND ALL CENTRAL OFFICE PERSONNEL EXCEPT PERSONNEL CLASSIFIED AS A SUPERINTENDENT)		2%	1%	6%	0%
INPUT	12. TAX LEVY (IN WHOLE MILLS) FOR EDUCATIONAL PURPOSES FOR CURRENT OPERATING EXPENSES (FROM 1974-75 ANNUAL REPORT OF THE STATE SUPERINTENDENT OF EDUCATION)		76	82	145	38
INPUT	13. EXPENDITURES PER PUPIL IN ADA FOR TOTAL CURRENT OPERATING EXPENSE (CURRENT OPERATING EXPENDITURES AS REPORTED BY THE DISTRICTS AT THE END OF THE 1974-75 SCHOOL YEAR INCLUDING A PRO RATA SHARE OF COUNTY BOARD EXPENDITURES AND AREA VOCATIONAL CENTER EXPENDITURES AS APPLICABLE. EXPENDITURES, AS DEFINED ARE DIVIDED BY THE AVERAGE DAILY ATTENDANCE FOR THE 180-DAY PERIOD, 1974-75)		\$1073	\$912	\$1241	\$606

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COUNTY Y DISTRICT X

INPUT INDICATORS

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100278

RANGE FOR STATE

INPUT 14. MEAN SALARY FOR TEACHERS (BEDS, 1974-75)
INSTRUCTIONAL (INCLUDES TEACHERS OF SPECIAL EDUCATION, BOTH SELF-CONTAINED AND
RESOURCE, REGULAR CLASSROOM TEACHERS, AND OTHER PROFESSIONAL INSTRUCTIONAL STAFF)

DISTRICT	STATE	HIGH	LOW
LESS THAN BACHELOR DEGREE	\$9145	\$8890	\$14128 \$3254
BACHELOR DEGREE	\$8172		\$9647 \$6249
BACHELOR DEGREE PLUS 18 HOURS	\$9800	\$9724	\$10940 \$7848
MASTERS DEGREE	\$11014	\$10843	\$12047 \$7685
SIX-YEAR CERTIFICATE	NA	\$11877	\$14431 \$9861
DOCTORS DEGREE	NA	\$11800	\$16116 \$6950

NON INSTRUCTIONAL (INCLUDES LIBRARIANS, GUIDANCE COUNSELORS, AND OTHER PROFESSIONAL
INSTRUCTIONAL-ORIENTED STAFF)

LESS THAN BACHELOR DEGREE	NA	\$6258	\$14316 \$3456
BACHELOR DEGREE	\$8417	\$8730	\$11348 \$6784
BACHELOR DEGREE PLUS 18 HOURS	\$8563	\$10130	\$14928 \$7200
MASTERS DEGREE	\$11415	\$11517	\$16065 \$7104
SIX-YEAR CERTIFICATE	NA	\$12742	\$15273 \$9415
DOCTORS DEGREE	NA	\$12212	\$13675 \$10461

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CRITERION

1. SKILL AREAS

DISTRICT

STATE

GRADE 4 (COMPREHENSIVE TESTS OF BASIC SKILLS, OCTOBER, 1975 MEANS IN GRADE EQUIVALENTS)

READING	3.4	3.5
LANGUAGE	3.5	3.4
MATH	3.2	3.5
BATTERY TOTAL	3.3	3.4
REFERENCE SKILLS	3.5	3.7
SCIENCE	3.5	3.5
SOCIAL STUDIES	3.6	3.6

GRADE 7 (COMPREHENSIVE TESTS OF BASIC SKILLS, OCTOBER, 1975 MEANS IN GRADE EQUIVALENTS)

READING	6.6	6.1
LANGUAGE	6.9	5.8
MATH	6.3	6.0
BATTERY TOTAL	6.6	6.1
REFERENCE SKILLS	7.2	6.6
SCIENCE	6.7	6.5
SOCIAL STUDIES	6.3	5.9

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COUNTY Y DISTRICT X

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CRITERION		DISTRICT		STATE	
	2. STUDENT SURVEY AND ATTITUDE INVENTORY FOR GRADE 7 (FALL, 1974 MEANS, SCORES FOR EACH SCALE BELOW HAVE A MAXIMUM VALUE OF 12.0 AND A MINIMUM VALUE OF 3.0. A FULL EXPLANATION FOR EACH SCALE IS FOUND IN -- ABSTRACT, FALL, 1974, SOUTH CAROLINA STUDENT SURVEY AND ATTITUDE INVENTORY.)				
	INDIVIDUAL ADEQUACY	7.9		7.8	
	SOCIAL ADEQUACY	8.5		8.2	
				RANGE FOR STATE	
CRITERION	3. DROPOUTS (CUMULATIVE 1974-75 DROPOUTS AS PERCENTAGE OF 180-DAY 1974-75 ENROLLMENT)	DISTRICT	STATE	HIGH	LOW
	ELEMENTARY	0%	0%	2%	0%
	SECONDARY	3%	3%	9%	0%
CRITERION	4. EMPLOYMENT RATE OF TERMINAL VOCATIONAL STUDENTS (STUDENTS WHO COMPLETED A VOCATIONAL PROGRAM IN 1973-74 AND WERE EMPLOYED IN FALL OF 1974 AS A PERCENTAGE OF TOTAL STUDENTS WHO COMPLETED A VOCATIONAL PROGRAM IN 1973-74)	62%	48%	100%	16%
CRITERION	5. PERCENTAGE OF 1973-74 GRADUATES ENROLLED IN A POST SECONDARY EDUCATIONAL INSTITUTION IN THE FALL OF 1974 (BEDS, 1974-75 POST SECONDARY EDUCATIONAL INSTITUTIONS ARE JUNIOR COLLEGES, SENIOR COLLEGES, TEC, BUSINESS SCHOOL, AND OTHER SCHOOLS)	51%	55%	89%	13%

Definitions of the Study Variables

Following are the definitions of the variables used in the Indicators of Educational Quality study. For convenience, the variables are listed by the variable categories: context, input, criterion, and classification.

Context Variables:

WHITEPCT	White percent, computed as follows: number of white pupils in 180-day enrollment divided by total pupils in 180-day enrollment, in all grades, for 1974-75, multiplied by 100; context variable by school.
LUNCHPCT	Lunch percent, computed as follows: 100 multiplied by average number of students receiving free or reduced-cost school lunch divided by average total students eating school lunch, computed in September 1975; context variable by school.
REVENUE	Local revenue per pupil, or total receipts for the year ending June 30, 1975, from the <u>Annual Report of the State Superintendent of Education, 1974-75</u> divided by average daily attendance from the 180-day report, 1974-75 (Debt-service funds were excluded from local receipts, but <u>pro rata</u> shares of area vocational center receipts and county board receipts were included); context variable by district.
SPARCITY	A measure of "density," computed as follows: total pupils in average daily attendance from the 1974-75 180-day report divided by the square land miles in the school district; context variable by district.

Input Variables:

ATTENPCT	Attendance percent, computed as follows: 100 multiplied by daily attendance divided by average daily membership, using the 180-day report for 1974-75; input variable by school.
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TRAINPCT EDUCPCT ORTHOPCT EMOTLPCT HEARGPCT VISULPCT LEARNPCT	Percentage of average daily membership (ADM) pupils with various handicapping conditions (trainable, educable, orthopedically, emotionally, hearing, visually, and learning disabled), based on ADM by handicapping category from the 180-day cumulative report for 1974-75; input variables by district. Each handicapped pupil was counted only once by major handicapping condition. Therefore, these seven percentages may be summed to determine the total percentage of handicapped pupils in self-contained classrooms; input variables by district.
K_1STPCT	Percentage of first grade enrollment in public kindergarten computed as follows: 100 multiplied by public kindergarten enrollment divided by first grade enrollment, both of which are from the 1974-75 180-day report; input variable by district.
ENGCLASS	Average class size in English, computed as follows: the number of pupils enrolled in English divided by the total number of English classes from the 1974-75 BEDS forms; input variable by district.
MATHCLAS	Average class size in mathematics, computed as follows: the number of pupils enrolled in mathematics divided by the total number of mathematics classes from the 1974-75 BEDS forms; input variable by district.
HISTCLAS	Average class size in history, computed as follows: the number of pupils enrolled in history divided by the total number of history classes from the 1974-75 BEDS forms; input variable by district.
SCICLAS	Average class size in science, computed as follows: the number of pupils enrolled in science divided by the total number of science classes from the 1974-75 BEDS forms; input variable by district.
T_ED_1 T_ED_2 T_ED_3 T_ED_4 T_ED_5 T_ED_6	Percentages of staff classified as teachers (special education teachers in either self-contained or resource, classroom teachers, and other professional instructional staff) whose educational levels are (1) less than bachelor's degree, (2) bachelor's degree, (3) bachelor's degree plus 18 hours, (4) master's degree, (5) six-year certificate, and (6) doctor's degree, according to the 1974-75 BEDS forms; input variables by school.

T_ED_ALL	Total number of staff classified as teachers (special education teachers in either self-contained or resource classrooms, classroom teachers, and other professional instructional staff) from the 1974-75 BEDS forms; input variable by school.
AD_ED_1 AD_ED_2 AD_ED_3 AD_ED_4 AD_ED_5 AD_ED_6	Percentages of district staff classified as administrators (superintendent, supervisor, director, consultant, coordinator, or principal whose educational levels are (1) less than bachelor's degree, (2) bachelor's degree, (3) bachelor's degree plus 18 hours, (4) master's degree, (5) six-year certificate, and (6) doctor's degree, according to the 1974-75 BEDS forms; input variables by district.
AD_ED_TL	Number of district staff classified as administrators according to 1974-75 BEDS forms; input variable by district.
YRS_EXP	Average years experience in education for school professional staff including all special education teachers, classroom teachers, other professional instructional staff, librarians, guidance counselors, and other professional instructional-oriented staff, according to 1974-75 BEDS forms; input variable by school.
NO_CERT	Percentage of total instructional time spent by teachers (special education teachers, classroom teachers, and other professional instructional staff) in teaching areas outside their area(s) of certification, according to the 1974-75 BEDS forms; input variable by school.
T_SAL_1 T_SAL_2 T_SAL_3 T_SAL_4 T_SAL_5 T_SAL_6	Mean annual salary in dollars for teachers (special education teachers, classroom teachers, and other professional instructional staff) whose educational levels are (1) less than bachelor's degree, (2) bachelor's degree, (3) bachelor's degree plus 18 hours, (4) master's degree, (5) six-year certificate, and (6) doctor's degree, according to the 1974-75 BEDS forms; input variables by district.
T_SAL_TL	Mean annual salary in dollars for all instructional staff members (special education teachers, classroom teachers, and other professional instructional staff) according to the 1974-75 BEDS forms; input variable by district.

NI_SAL_1	Mean annual salary in dollars for noninstructional staff members (librarians, guidance counselors, and other professional instructional-oriented staff) whose educational levels are (1) less than a bachelor's degree, (2) bachelor's degree, (3) bachelor's degree plus 18 hours, (4) master's degree, (5) six-year certificate, and (6) doctor's degree according to the 1974-75 BEDS forms; input variables by district.
NI_SAL_2	
NI_SAL_3	
NI_SAL_4	
NI_SAL_5	
NI_SAL_6	
NI_SAL_T	Mean annual salary in dollars for all staff classified as noninstructional (librarians, guidance counselors, and other professional instructional-oriented staff) according to the 1974-75 BEDS forms; input variable by district.
TURNOVER	Percentage of teachers requiring replacement (a) who were employed at least 100 days and teaching at least 180 minutes per day, and (b) who were teachers in the 12 grades, special education classes, or ungraded classes, and left their positions, from the State Aid File; input variable by district.
PERPUPIL	Expenditure in dollars per pupil in average daily attendance; input variable by district expenditure is total current operating expenditures as reported by the districts at the end of the 1974-75 school year including a <u>pro rata</u> share of county board expenditures and area vocational center expenditures, where applicable. Average daily attendance is from the 180-day report for 1974-75; input variable by district.
CENT_OFF	Percentage of all district staff requiring certification who comprise the central office staff, according to the 1974-75 BEDS forms; input variable by district.
TAX_LEVY	Tax levy in whole mills for educational purposes for current operating expenses, according to the <u>Annual Report of the State Superintendent of Education, 1974-75</u> ; input variable by district.

Added Input Variables:

BATT4N	Number of pupils in 4th grade who took each of the reading, language, and mathematics subtests of the <u>Comprehensive Tests of Basic Skills, Form S, Level I</u> , in the fall of 1974, according to data supplied by the CTB/McGraw-Hill; input variable by school.
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BATT7N

Number of pupils in 7th grade who took each of the reading, language, and mathematics subtests of the Comprehensive Tests of Basic Skills, Form S, Level II, in the fall of 1974, according to data supplied by CTB/McGraw-Hill; input variable by school.

Criterion Variables:

READ4
LANG4
MATH4
BATT4
REFER4
SCIENCE4
SOCSTUDY4

Schoolwide mean expanded (standard) scale scores, aggregated over all 4th grade participants in the 1974 Statewide Testing Program in the following subscales of the Comprehensive Tests of Basic Skills, Form S, Level I: Reading Total, Language Total, Mathematics Total, Battery Total, Reference Skills, Science, and Social Studies, respectively, according to data supplied by CTB/McGraw-Hill; criterion variables by school.

READ7
LANG7
MATH7
BATT7
REFER7
SCIENCE7
SOCSTUDY7

Schoolwide mean expanded (standard) scale scores, aggregated over all 7th grade participants in the 1974 Statewide Testing Program in the following subscales of the Comprehensive Tests of Basic Skills, Form S, Level II: Reading Total, Language Total, Mathematics Total, Battery Total, Reference Skills, Science, and Social Studies, respectively, according to data supplied by CTB/McGraw-Hill; criterion variables by school.

SSAI_IA
SSAI_SA

Schoolwide mean scores, aggregated over all 7th grade participants in the 1974 Statewide Testing Program on the Student Survey and Attitude Inventory, broken out by the two subscales, Individual Adequacy and Social Adequacy, respectively, according to scoring results by the Office of Research, Department of Education; criterion variables by school.

DROPOUT

Percentage of the 180-day enrollment who left school within the school year without graduating, according to the 1974-75 180-day report; criterion variable by school.

COLLPCT

Percentage of 1973-74 graduates enrolled in a post-secondary educational institution (junior college, senior college, TEC school, business school, or other school) in the fall of 1974, according to the 1974-75 BEDS forms; criterion variable by school.

EMP_RATE Percentage of graduates of a vocational program
in 1973-74 who were employed in the fall of 1974;
criterion variable by district.

Classification Variables:

ADA Number of pupils in average daily attendance
according to the 1974-75 180-day report; input vari-
able by school.

NGRADE Number of grade levels, excluding kindergarten, in
a school's organizational structure, obtained from
the BEDS survey, 1974-75; input variable by school.

APPENDIX B**Description of the Preliminary Analyses of the Study Variables
and Rationale for Variable Modifications**

Description of the Preliminary Analyses of the Study Variables and Rationale for Variable Modifications

Following is a brief description of the preliminary analyses of each variable or cluster of variables and a rationale for each of the variable modifications. The discussion is limited to context and input variables as they relate to the prediction of 4th and 7th grade Comprehensive Tests of Basic Skills, Form S, (CTBS/S) school means for the battery totals (BATT4 and BATT7).

Context Variables:

- | | |
|----------|---|
| WHITEPCT | This variable, the percentage of white students in school, was an excellent predictor of most of the criterion variables. A log transformation was attempted; but, since the correlations with the 4th and 7th grade CTBS/S battery totals were somewhat lowered by using this transformation, this idea was abandoned. |
| LUNCHPCT | This variable, the percentage of students in school on free or reduced lunch, was the single best predictor for both 4th and 7th grade <u>CTBS/S</u> battery totals, with correlations of $-.75$ and $-.83$ for the 4th and 7th grades, respectively. Therefore, this variable was retained in its original form. |
| REVENUE | This variable, which indicates the local revenue generated per pupil in the district, was badly skewed; and, therefore, the log transformation (referred to as REVLG) appeared appropriate. The fact that the correlations of REVLG with the cognitive criterion variables were somewhat larger than the correlations of REVENUE with the criterion variables and the coefficient of variation was greatly reduced supported the decision to use REVLG rather than REVENUE. |

SPARCITY

Actually a measure of school district density, the log transformation aided in reducing the skewness of the variable's distribution. However, based on simple correlations, SPARCITY did not appear to be a very useful predictor. Thus, SPARLG was used in the analyses.

Input Variables:

ATTENPCT

This variable was a school variable and was retained in its original form.

K_1ST_PCT

This variable, an estimate of the percentage of kindergarten attendance, correlated fairly substantially (but negatively) with the CTBS/S battery totals. This negative correlation possibly reflects the fact that public kindergarten is more readily available in disadvantaged areas. Consequently, this variable was retained without transformation.

TRAINPCT
EDUCPCT
ORTHOPCT
EMOTLPCT
HEARGPCT
VISULPCT
LEARNPCT

Seven district measures of percentage of student enrollment in various special education programs were considered. These percentages were small, and a decision was made to sum them in order to obtain a proxy for availability of special programs. Further analysis indicated that a log transformation would reduce the skewness associated with this variable. Therefore, the log transformation referred to as SPECLG was generated.

ENGCLASS
MATHCLAS
HISTCLAS
SCICLAS

The average district class sizes in English, math, history, and science were inappropriate for schools used in our principal analyses, i.e., the analysis of 4th and 7th grade CTBS/S data for battery total. For this reason, these four variables were not considered in the analyses.

T_ED_1
T_ED_2
T_ED_3
T_ED_4
T_ED_5
T_ED_6

There were six school variables dealing with the percent of teachers at each of six educational levels, ranging from less than a bachelor's degree to a doctorate. A final variable in the set, T_ED_ALL, was actually the number of teachers in the school and was independent of educational level. Inclusion of the six educational level variables in the prediction equation did not seem appropriate; therefore, identification of

some single index of the educational level of the teachers in a school was more logical. To facilitate this objective, BATT4 and BATT7 were regressed onto the six variables for the 4th and 7th grade samples, respectively. When this regression was performed, the only variable significant at the 5% level was T_ED_1 for the 4th grade sample. T_ED_1 was the percent of teachers in the school with less than a bachelor's degree and carried a negative coefficient. For the 7th grade, none of the predictors were significant; but T_ED_1 was the best of the group ($p=.107$). For this reason a decision was made to retain this single predictor as a proxy for the educational level of the teachers in the school. The R^2 values from the multiple regression were small for both samples, .023 for 4th grade and .056 for the 7th grade. Because of the extremely skewed nature of the variable (88% of the elementary schools and 83% of the secondary schools have 1% or fewer teachers without bachelor's degrees), a decision was made to use the log transformation TLG1. Thus, TLG1 was used as a predictor in the regression analyses.

AD_ED_1
AD_ED_2
AD_ED_3
AD_ED_4
AD_ED_5
AD_ED_6

The six variables describing the educational level of the administrative staff in the district paralleled the six variables reflecting teacher educational levels. An analysis similar to the one described above for teacher educational levels was carried out for these variables. In this case, the three categories of highest educational level were significant at the 5% level for predicting BATT4; and the two highest were significant for predicting BATT7. The inconsistent category was AD_ED_4 which reflects attainment of a master's degree. Since AD_ED_4 was significant at the 10% level for the 7th grade sample, the decision to treat these variables in the same fashion for both grade levels was made. The three category percentages were summed, and the new variable AD456 was used in the analyses.

YRS_EXP

This variable, average years of experience of school teaching staff, was retained in its original form in the analyses.

NO_CERT

This variable reflects percentage of school teaching staff who are engaged in teaching in areas in which they are not certified. The distribution was very skewed with 73% of the schools having 4% or fewer teachers in this category; however, values ranged above 50% for the total data set. Both a log and a square root transformation were attempted. The square root transformation, termed NOCSQ, proved to be slightly better than the log transformation and was used in the analyses.

T_SAL_1
T_SAL_2
T_SAL_3
T_SAL_4
T_SAL_5
T_SAL_6
T_SAL_TL

The first six variables are district values for average teacher salaries for the six teacher educational levels mentioned previously. There were very little data available for T_SAL_1, T_SAL_4, and T_SAL_6. This lack of data probably reflects the fact that many districts have no teachers at these educational levels. In order to avoid further depletion of the sample size, an attempt was made to work around this difficulty. Since T_SAL_2 and T_SAL_3 were highly correlated ($r=.91$), only one of them needed to be retained. T_SAL_2 was selected since the data for this variable were slightly more complete. Because the mean salary levels for teachers beyond the master's degree level were excluded from the analysis, the decision was made to retain T_SAL_TL for which data were complete. This variable reflected the average salary for all teachers in the district. Although T_SAL_TL was rather highly correlated with T_SAL_2 ($r=.75$), the hope was that T_SAL_TL would account for a slightly different financial factor than T_SAL_2.

NI_SAL_1
NI_SAL_2
NI_SAL_3
NI_SAL_4
NI_SAL_5
NI_SAL_6

These six variables provide the average salary of district personnel (non-instructional staff) by educational level. In addition, an average for these individuals independent of educational level, referred to as NI_SAL_T, was available. Again, since many districts do not employ personnel at all educational levels, the data on the six variables were quite incomplete; however, complete data were available for NI_SAL_T. Although the correlations between NI_SAL_T and the two battery totals (BATT4 and BATT7) were slightly larger than those of NI_SAL_T, the number of schools reporting this variable was insufficient to warrant retention of NI_SAL_T. Since NI_SAL_T

had the second highest correlations with the criterion variables and was itself highly correlated with the other salary categories, NI SAL T was chosen to represent this set of variables in future analyses.

TURNOVER	The rate of turnover of teaching staff in the district was utilized in the analyses without modification.
PERPUPIL	The expenditure per pupil in the district was used in the analyses without modification.
CENT_OFF	This variable, the percentage of all district professional personnel staff comprising the central administration staff, was used in the analyses without modification.
TAX_LEVY	This variable, district tax levy in mills, was dropped from consideration because data were available on only about 70% of the schools.
ADA	Because of the extreme variation and the skewness in this variable, school average daily attendance (93 schools with 25 or fewer students but about 9% with more than 1,000 students), this variable required a log transformation in order for it to meet the model assumptions. ADALG was used to refer to this variable in future analyses.

APPENDIX C

Raw Score Regression Equations for Predicting

BATT4 (4th Grade) and BATT7 (7th Grade)

Using Four Context Variables and Significant Input Variables

Raw Score Regression Equations for Predicting BATT4 (4th Grade) and BATT7 (7th Grade)
Using Four Context Variables and Significant Input Variables

School Group	<u>n</u>	<u>R</u> ²	Constant	Regression Coefficients Associated with Context Variables				Labels and Regression Coefficients for Significant Input Variables				
				WHITEPCT	LUNCHPCT	REVLG	SPARLG					
4th Total	512	.629	-39.908	.041	-.141	9.762	-1.180	.687 ATTENPCT	-.001 T_SAL_TL	2.334 ADALG	.049 CENT_OFF	-.001 T_SAL_2
4th Small	61	.670	57.010	.116	-.039 (NS)	17.852	-5.672	-.002 T_SAL_TL	-.203 BATT4N	.702 ATTENPCT	.172 CENT_OFF	
4th Medium	160	.535	-21.780	.048	-.103	4.011 (NS)	1.198 (NS)	.524 ATTENPCT				
4th Large	291	.690	-47.150	.010 (NS)	-.186	8.997	-.719 (NS)	.826 ATTENPCT	-.002 T_SAL_2	.068 CENT_OFF	2.775 ADALG	

(NS) indicates that the context variable was not significantly different from zero at the 10% level.

APPENDIX D

Mock-up of District Outlier Summary

School District X

Following is a report of predicted and measured mean school achievement for schools in School District X in which 4th graders responded to the Comprehensive Tests of Basic Skills, Form S, Level 1, in the fall of 1975.

Elementary School #1

	Grade Equivalent	%ile
Measured (Actual) Achievement (Battery Total Subtest)	4.7	
Predicted Achievement among All 4th Grade Schools	3.9	
Percentile Rank of the Difference		97**
Predicted Achievement among Large 4th Grade Schools	3.9	
Percentile Rank of the Difference		98**

Elementary School #2

	Grade Equivalent	%ile
Measured (Actual) Achievement (Battery Total Subtest)	2.6	
Predicted Achievement among All 4th Grade Schools	3.5	
Percentile Rank of the Difference		0*
Predicted Achievement among Medium 4th Grade Schools	3.5	
Percentile Rank of the Difference		1*

Elementary School #3

	Grade Equivalent	%ile
Measured (Actual) Achievement (Battery Total Subtest)	4.4	
Predicted Achievement among All 4th Grade Schools	4.1	
Percentile Rank of the Difference		81
Predicted Achievement among 4th Grade Schools	4.1	
Percentile Rank of the Difference		76

* Indicates a "negative outlier" school.

** Indicates a "positive outlier" school.

Following is a report of predicted and measured mean school achievement for schools in School District X in which 7th graders responded to the Comprehensive Tests of Basic Skills, Form S, Level 2, in the fall of 1975.

Middle School #1

	Grade Equivalent %ile	
Measured (Actual) Achievement (Battery Total Subtest)	6.4	
Predicted Achievement among All 7th Grade Schools	6.6	
Percentile Rank of the Difference		38
Predicted Achievement among Large 7th Grade Schools	6.6	
Percentile Rank of the Difference		37

Middle School #2

	Grade Equivalent %ile	
Measured (Actual) Achievement (Battery Total Subtest)	4.3	
Predicted Achievement among All 7th Grade Schools	5.7	
Percentile Rank of the Difference		1*
Predicted Achievement among Large 7th Grade Schools	6.0	
Percentile Rank of the Difference		0*

* Indicates a "negative outlier" school.

** Indicates a "positive outlier" school.

S C H O O L	W H I T E P C T	L U N C H P C T	R E V E N U E	S P A R C I T Y	A T T E N P C T	T S A L Z	T S A L T L	A D A	C E N T O F F	B A T T 4 N	S P E C P C T	T E D T	A D 4 5 6
El School #1	80	28.9	23	18	96	8550	9870	554	55	93	2.3	4	81
El School #2	68	36.9	23	18	94	8550	9870	199	19	18	2.3	0	81
El School #3	88	18.5	23	18	96	8550	9870	785	78	122	2.3	3	81
Mid School #1	59	31.6	23	18	93	8550	9870	671	67		2.3	0	81
Mid School #2	54	59.9	23	18	98	8550	9870	485	48		2.3	4	81